3P236 X-ray structural analysis of the N photoreaction intermediate of halorhodopsin in complex with bromide ion

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Halorhodopsin from N. pharaonis (pHR) is a retinylidene protein that functions as a light-driven chloride ion pump.

In this study, we investigated the structure of a reaction intermediate of pHr-bromide ion complex that was accumulated under illumination at 240K.

The structure analysis showed that the three subunits in the asymmetric unit underwent different structural changes.

In the subunit with the EF loop facing a free space, a profound outward movement of the cytoplasmic half of helix F took place, while the middle moiety of helix C moved inward. In this reaction state (possibly the N state), the bromide ion that initially existed in the active site moved across the Schiff base and occupied a site at the cytoplasmic vicinity of the Schiff base.

3P237 Trapping the photoactive form of squid rhodopsin in the P62 crystal

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Upon absorption of light, rhodopsin undergoes a photocycle maturation. Forced-expression of NDRG1b or NDRG1a-v1 in rods altered morphology.

Shimpei Takita

1


In this study, we developed a method to trap the late intermediate of squid rhodopsin. When soaked with all-trans retinal, the color turned to yellow-orange and red-orange.

The movement of the cytoplasmic half of helix F took place, while the middle moiety of helix C moved inward. In this reaction state (possibly the N state), the bromide ion that initially existed in the active site moved across the Schiff base and occupied a site at the cytoplasmic vicinity of the Schiff base.

3P238 NDRG1 protein in photoreceptors


A carp orthologue of mammalian ndrgl (n-myc downstream-regulated gene 1), ndrglb, is a cone-specific gene with unknown function. The purpose of this study is to understand the function of this protein in cones using zebrafish, akin to carp. NDRG1b protein was localized to the plasma membrane (PM) of the inner segment (IS) and the outer segment (OS) in cones. Its newly isolated paralogue NDRG1a-v1 showed similar subcellular localization in cones, but in rods, this protein was present only in the IS PM. Knockdown of ndrg1b in larvae altered morphology.

3P239 Quantitative Aspects of cGMP Phosphodiesterase Activation in Carp Rods and Cones

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Light sensitivity is lower in cones than in rods. We previously showed that activation of cGMP phosphodiesterase (PDE), a hydrolyzing enzyme of the 2nd messenger cGMP in rods and cones, requires >200 times more light in cones than in rods. This lower PDE activation efficiency in cones is partly due to 5 times lower activation rate of transducin by activated visual pigment (R*) in cones than in rods.

However, this difference does not explain the >200 times difference in the PDE activation between rods and cones. In the present study, therefore, to understand the underlying mechanism of the remaining >40 times difference, we compared in rods and cones (1) the efficiency of PDE activation by activated transducin (Tr*), and (2) the contribution of lifetimes of R* and Tr*.

3P240 Time-resolved study on the intermolecular interaction change in the signal transduction of LOV protein YtvA

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YtvA is a blue light sensor protein composed of the N-terminal LOV domain, linker domain, and the C-terminal STAS domain. Physiological experiments have shown that the YtvA acts as a positive regulator for environmental stress responses (light and salt stresses) regulated by the σB factor. However, the molecular mechanism of its signal transduction has not been revealed yet. For understanding this mechanism, we have studied the photoreaction dynamics of full-length protein and its truncated constructs. In addition, we are investigating the intermolecular interaction change with RsbRA, which is a partner protein of YtvA in the living cell.

We will discuss the signaling process in more detail at the conference.

3P241 Light induced reaction dynamics of a BLUF photoreceptor PapB


The BLUF (Blue-Light Using Flavin adenine dinucleotide) protein PapB is a blue light receptor which controls the biofilm formation of the purple photosynthetic bacterium Rhodopseudomonas palustris by enhancing the phosphodiesterase activity of the EAL domain protein PapA, which hydrolyzes the second messenger cyclic dimeric AMP. In order to elucidate the signaling mechanism, we investigated the light-induced reaction of PapB in vitro by Transient Grating method. Analyzing the TG signals, we detected light-induced volumetric change commonly observed in BLUF proteins. This dynamics was followed by significant change of diffusion coefficient. These reactions were spectrally silent processes and the details of photochemistry are presented at the symposium.