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NEW SENSORY FUNCTION OF MICROBIAL RHODOPSIN IN PHOTOSYNTHETIC MICROBES

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Microbial rhodopsins, photoactive seven transmembrane proteins which contain *all-trans* retinal as a chromophore, have been known for three decades and extensively studies in extreme halophiles. Photosynthetic microbes possess a wealth of photoactive proteins including chlorophyll-based pigments, phototropin-related blue light receptors, phytochromes, and cryptochromes. Surprisingly, recent genome sequencing projects discovered additional photoactive proteins, retinal-based rhodopsins, in cyanobacterial and algal genera. Analysis of the *Anabaena* and *Chlamyrhodopsin* revealed that they have sensory functions, which based on our work with haloarchaeal rhodopsins, may use a variety of signaling mechanisms. *Anabaena*rhodopsin is interacted with a 14kDa soluble transducer and the putative function is not yet identified. The *Anabaena* rhodopsin shows a visible light-absorbing pigment (lmax=543nm) and the mutation of retinal binding pocket (P206E) shifts the absorption maximum to the blue. Two *Chlamydomonas* rhodopsins are involved in phototaxis and photophobic responses based on electrical measurements by RNA*i* experiment. In order to analyze the protein, we developed a sensory rhodopsin expression system in *Escherichia. coli.* The opsin in *E. coli* bound endogenous *all-trans* retinal to form a pigment and can be observed on the agar plate.

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