[C1-7]

Cyanobacterial Light-Driven Proton Pump, *Gloeobacter* Rhodopsin

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Microbial rhodopsins are retinal-binding, seven transmembrane helix proteins which function as ion pumps and photosensory receptors. A gene encoding a homologue of type I microbial rhodopsin was found in the genome of a unicellular cyanobacterium, *Gloeobacter violaceus* PCC7421 (www.kazusa.or.jp), which is believed to be primitive because of the lack of thylakoids. The *Gloeobacter* rhodopsin (GR) gene encodes a polypeptide of 298 amino acids, with a molecular weight of 33 kDa. The gene was functionally expressed in *Escherichia coli* and bound all-*trans* retinal to form a pigment (λ_{max}=544 nm at pH 7) and showed a light-driven proton pumping activity similar to proteorhodopsin. The pigment did not exhibit proton transport activity when Asp121 (homolog of Asp85 in BR) was replaced with Asn and Glu132 (Asp96 in BR) with Gln. The pK_a of Asp121, the putative proton acceptor for the Schiff base, is approximately 5.1, so GR can translocate H^+ under physiological (pH 7.4) conditions using the wavelength of light different to those for chlorophyll. We suggested that GR pumps the proton outside of the cell together with the chlorophyll-based machinery.