

## Expression Regulation of Membrane Protein by Codon Variation of Amino Acid at N-Terminal Region

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**Abstract :** Microbial rhodopsins are well-known seven-transmembrane proteins that have been extensively studied. These retinal-binding proteins have divided into two types. The type I is microbial rhodopsin, and type II (visual pigment) is expressed mostly in mammalian eyes. For type I rhodopsin, there are two main functions that are ion pumping activity and sensory transduction. Anabaena sensory rhodopsin (ASR) is one of the microbial rhodopsin with main function as photo-sensory transduction. Although ASR is expressed fairly well in *Escherichia coli*, the expression level is relatively less compare to Proteorhodopsin. In this study, full length of ASR was used to test for the expression influence by codon usage in *E. coli*. Eight amino acids of codon at N-terminal part of ASR were changed randomly with designed primers, which allow 8,192 nucleotide different cases. The codon changes were screened for the preferable codons of each residue, which have given higher expression yield. Among those 57 selected mutations, there are 24 color-enhanced *E. coli* colonies that contain ASR proteins, and it showed better expression level than the wild type ASR codon usage. This strongly suggests that high codon usage of only partial N-terminal of protein can increase the expression level of whole protein.

**Keywords :** 7-transmembrane, all-trans retinal, rhodopsin, codon-usage, protein expression

**Conference Title :** ICBMSB 2018 : International Conference on Biological Morphology and Synthetic Biology

**Conference Location :** Singapore, Singapore

**Conference Dates :** March 22-23, 2018