IS1.4 - Engineered Biosynthesis of Bacteriochlorophyll g_F in *Rhodobacter sphaeroides*

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Engineering photosynthetic bacteria to utilize a heterologous reaction center that contains a different (bacterio)chlorophyll could improve solar energy conversion efficiency by allowing cells to absorb a broader range of the solar spectrum. One promising candidate is the homodimeric type I reaction center from *Heliobacterium modesticaldum*. It is the simplest known reaction center and uses bacteriochlorophyll (BChl) *g*, which absorbs in the near-infrared region of the spectrum. Like the more common BChls *a* and *b*, BChl *g* is a true bacteriochlorin. It carries characteristic C3-vinyl and C8-ethylidene groups, the latter shared with BChl *b*. The purple phototrophic bacterium *Rhodobacter* (*Rba.*) *sphaeroides* was chosen as the platform into which the engineered production of BChl g_F, where F is farnesyl, was attempted. Using a strain of *Rba. sphaeroides* that produces BChl b_P, where P is phytyl, rather than the native BChl a_P, we deleted *bchF*, a gene that encodes an enzyme responsible for the hydration of the C3-vinyl group of a precursor of BChls. This led to the production of BChl g_P. Next, the *crtE* gene was deleted, thereby producing BChl *g* carrying a THF (tetrahydrofarnesol) moiety. Additionally, the $bchG^{Rs}$ gene from *Rba. sphaeroides* was replaced with $bchG^{Hm}$ from *Hba. modesticaldum*. To prevent reduction of the tail, *bchP* was deleted, which yielded BChl g_F. The construction of a strain producing BChl g_F validates the biosynthetic pathway established for its synthesis and satisfies a precondition for assembling the simplest reaction center in a heterologous organism, namely the biosynthesis of its native pigment, BChl g_F. (Supported by NSF grant MCB-1331173.)