Supplemental Data

Single transmembrane helix

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          :*:***********.*  :;*:**:****  *.***  ***:.***
Syn6803  -MSDLNRGIMKFDGADKPFLVAVSAMLILGGIGALIIWALRVAYAVG   46
Thermo   MATDFNRGIMKFDGADSPAMIAISAVLILGFIAALIWWALHTAYA--   45
ruler    1.......10........20........30........40.......
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Supplemental Figure S1. Sequence comparison between an ORF product (*Synechocystis* sp. strain PCC 6803) and NdhQ (*Thermosynechococcus elongatus*). The sequences were aligned using ClustalX 1.83. Asterisks indicate identical amino acids; colons and dots indicate conserved amino acid substitutions. Membrane domain analysis was performed by the TMHMM software and single transmembrane helix was signed.
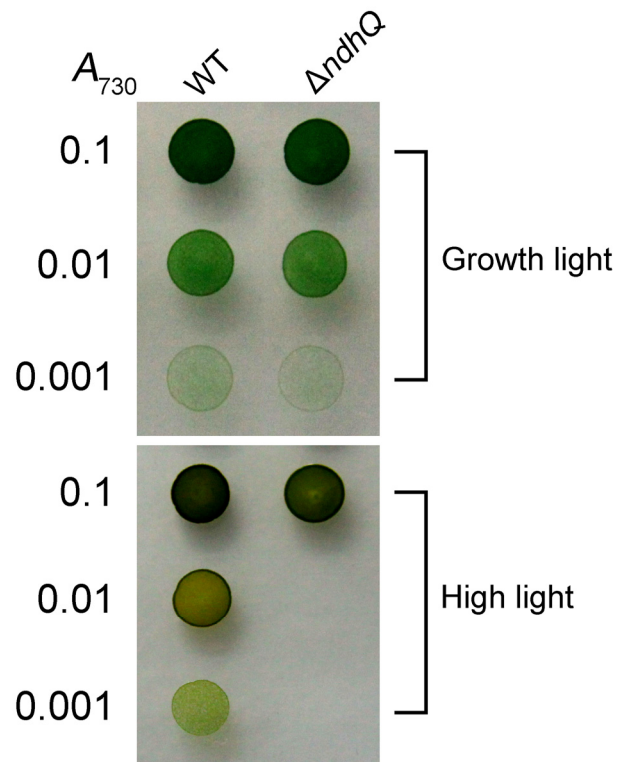
Supplemental Figure S2. Growth of WT and Δ*ndhQ* cells on the agar plates under different light intensities. Three μl of cell suspensions with densities corresponding to A_{730} nm values of 0.1 (upper rows), 0.01 (middle rows), and 0.001 (lower rows) were spotted on agar plates and were incubated under 2% CO_2 in air (*v/v*) at normal light (40 μmol photons $m^{-2}s^{-1}$) and high light (200 μmol photons $m^{-2}s^{-1}$).
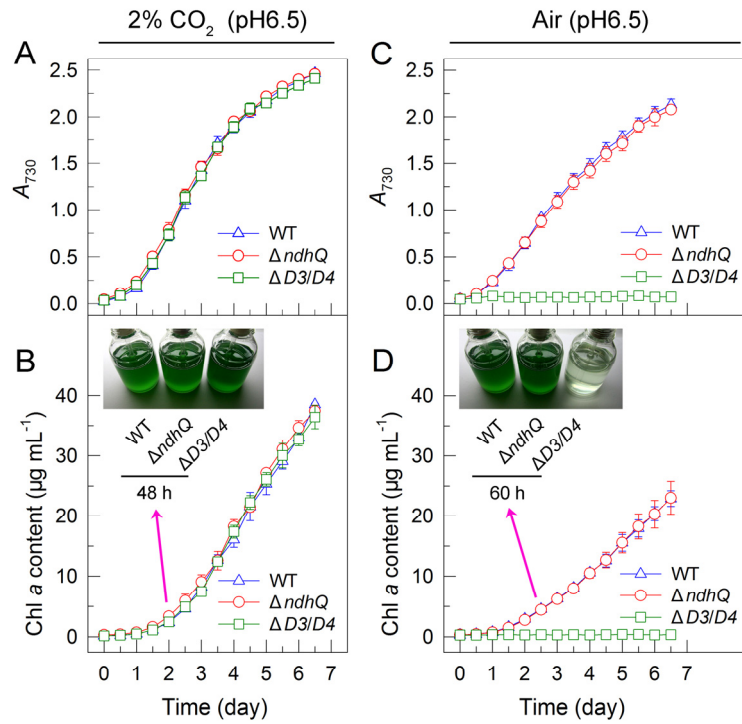
Supplemental Figure S3. Growth curve of WT, Δ*ndhQ* and Δ*D3/D4* cells. A and B, Cell density (A) and chlorophyll *a* content (B) were monitored under 2% CO_2 in air (*v/v*) and pH6.5. Values are means ± SD (*n* = 5). C and D, Cell density (C) and chlorophyll *a* content (D) were monitored under air level of CO_2 and pH6.5. Values are means ± SD (*n* = 5).
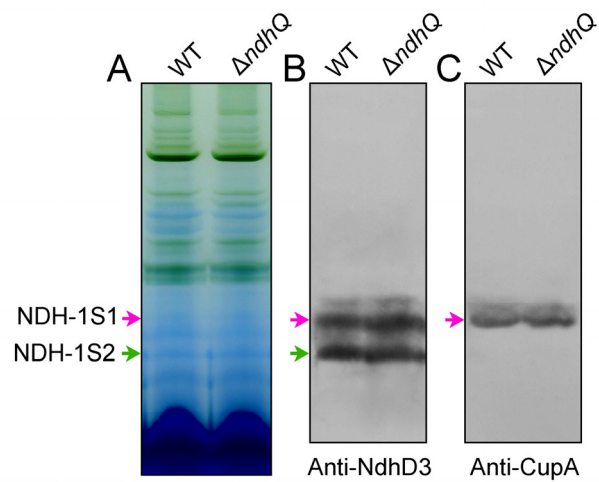
Supplemental Figure S4. Western analyses of NDH-1S complex from the air-grown WT and Δ*ndhQ* cells. A, Thylakoid protein complexes isolated from the air-grown WT and Δ*ndhQ* cells were separated by BN-PAGE. Thylakoid membrane extract corresponding to 7 μg chlorophyll *a* was loaded onto each lane. The position of NDH-1S1 and NDH-1S2 complexes was indicated by pink and green arrows, respectively. B, Protein complexes were electroblotted to a polyvinylidene difluoride membrane, and the membrane was cross-reacted with anti-NdhD3 and CupA to probe the assembly of NDH-1S complex.
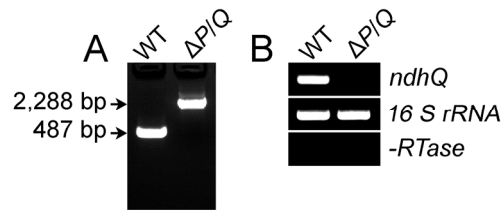
Supplemental Figure S5. Identification of the ΔP/Q double mutant. A, PCR segregation analysis of the ΔP/Q double mutant using the *ndhQ*-G and *ndhQ*-H primer sequences (Supplemental Table S1). B, Transcript levels of *ndhQ* in the WT and Δ*P/Q* strains. The transcript level of *16 S rRNA* in each sample is shown as a control. The absence of contamination of DNA was confirmed by PCR without reverse transcriptase reaction.

Supplemental Table S1. Primers used in this study.

Primers used for identifying the sites of transposon insertion.

Name	Primer sequence (5'–3')	Purpose
Transprimer-FP	ACCTACAACAAAGCTCTCATCAACC	Identifying the transposon insertion sites
Transprimer-RP	GCAATGTAACATCAGAGATTTTGAG	

Primers used to construct the pUC-Δ*ndhQ* vector.

Name	Primer sequence (5'–3')	Purpose
ndhQ-A	GCTGCAGCGGTGTTTAATTCGTCTAG	Amplification of upstream region
ndhQ-B	CGGATCCGAACTTACCGCCATCATC	
ndhQ-C	CGGGATCCAAAATAAAAAAGGGG	Amplification of spectinomycin gene
ndhQ-D	CGAGCTCAAAATAAAAAAGGGGACC	
ndhQ-E	CGAGCTCAAAACCGACTCTCCAAAAG	Amplification of downstream region
ndhQ-F	GGAATTCGCCTTTCTCGCTAGCATG	
ndhQ-G	CATCAACACACTACCCGCCAG	Segregation analysis
ndhQ-H	GATTCCCTGCTTTGGGCCATG	

Primers used to identify the segregation of *ndhQ* in Δ*ndhP/Q* mutant.

Name	Primer sequence (5'–3')
ndhQ-G	CATCAACACACTACCCGCCAG
ndhQ-H	GATTCCCTGCTTTGGGCCATG

Primers used to construct the pEYFP-NdhQ-YFP-His6 plasmid.

Name	Primer sequence (5'–3')	Purpose
ndhQ-yfp-his6-A	GCGTCGACTATTTCTGAAACTAATG	Amplification of *ndhQ* and its upstream region
ndhQ-yfp-his6-B	GGGTACCAAGCCCACAGCGTAG	
ndhQ-yfp-his6-C	GGAATTCGAACTTACCGCCATCATC	Amplification of downstream region
ndhQ-yfp-his6-D	GACTAGTGGCTACGGACACTCCCAC	
ndhQ-yfp-his6-E	GCGTCGACTATTTCTGAAACTAATG	Segregation analysis
ndhQ-yfp-his6-F	GACTAGTGGCTACGGACACTCCCAC	

Primers used for RT-PCR.

Name	Primer sequence (5'–3')	Purpose
ndhQ-FP	GTCAGACCTGAACCGTGGCATCATG	*ndhQ* transcript
ndhQ-RP	GCTACCCGTAGGGCCCAGATAATC	
16 S rRNA-FP	CGACTGCTAATACCCAATGTGC	*16 S rRNA* transcript
16 S rRNA-RP	GTCCCTCAGTGTCAGTTTCAGC	