Evaluating Changes To Excitation Energy Transfer Rates On High-Light Exposure In Two Model Cyanobacteria

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Light absorption by photochemically active pigments and proteins in photosynthetic organisms triggers reactions that fix light into usable chemical energy. Since the discovery of light reactions in photosynthetic organisms, many efforts have focused on understanding the excitation energy transfer (EET) mechanism through advanced spectroscopy. However, with the development of efforts to use cyanobacteria in synthetic biology, a critical approach has been taken to improve light tolerance. Increased light tolerance provides accelerated growth and excess energy that can be diverted for the sustainable production of chemicals without compromising growth. To better understand the changes in EET on high light exposure and what makes a strain more light-tolerant, we compared EET in the whole cells of *Synechocystis* sp. PCC 6803 and *Synechococcus elongatus* UTEX 2973. Using whole cells allowed us to study the EET under native conditions. We preferentially excited chlorophylls. Elucidating the means to overcome photoinhibition employed by *Synechococcus* 2973 is imperative for helping design strategies for increasing the light tolerance of cyanobacteria used for carbon-neutral bioproduction. Our observations suggest that *Synechococcus* 2973 employs a three-pronged strategy to overcome photoinhibition on prolonged growth under high light. These include the possible involvement of an uncommon OCP, tighter stoichiometric regulation of PSII/I, and reduction of light-harvesting antenna.

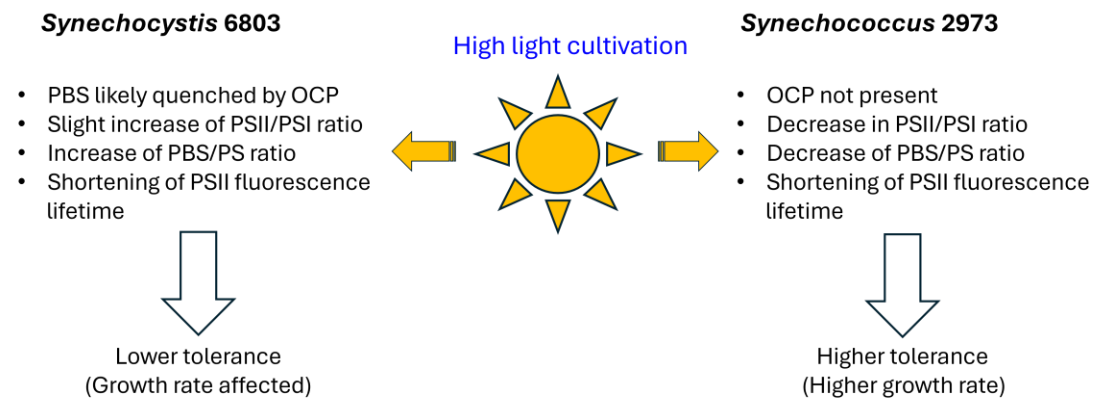

Figure. Schematic comparing the high light tolerance mechanism of *Synechococcus* 2973 with the response of *Synechocystis* 6803. Under high light, *Synechococcus* 2973 deploys more than one strategy to increase its tolerance to high light intensity. Key factors include a decline in light absorption by regulating PBS, an increase in PSI, and a decrease in PSII.

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