Role of a rhomboid protease in a CO_2-concentrating mechanism

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Photosynthetic efficiency of some of the most important global crop plants is limited by the low affinity for CO_2 of ribulose bisphosphate carboxylase–oxygenase (Rubisco) and the wastage of energy from photosynthesis via the release of fixed CO_2 in a side reaction with oxygen. Experimental increases in the CO_2 concentration around C3 plants did enhance the level of photosynthesis and yield, so it is of interest to investigate the crop-improvement potential of the CO_2-concentrating mechanism (CCM) utilised by cyanobacteria to overcome the limitations of Rubisco. Utilising this mechanism of improving Rubisco efficiency and thus crop yield is attractive as it does not necessarily require major changes to leaf anatomy.

The cyanobacterial CCM allows these photosynthetic prokaryotes to increase CO_2 concentration up to 1000-fold near carboxysomes, protein-walled compartments of localised Rubisco, and increased CO_2 levels also activate Rubisco and repress photorespiration. Within a complex network of CCM regulation is control at the level of transcription for genes encoding CO_2-uptake and bicarbonate transport. Amongst the regulatory components are LysR-type transcription factors acting as activators or repressors, and the protease FtsH2. We report here how a rhomboid protease also plays a pivotal role in transcriptional control of CCM genes in *Synechocystis* sp. PCC6803.