Photosynthetic diversity: are we concentrating too much on carbon?

Great progress is being made in understanding C4, CAM or the biophysical Carbon Concentrating Mechanism in algae and cyanobacteria. There have been recent tremendous new insights identifying key molecular components, their cell-specific targetting, and potential operation in alternative higher plant hosts. Using these advances as a starting point, we will then go on to consider the extent that other environmental drivers, such as nitrogen availability and recovery, as well as water supply and hydraulic conductance, could also have provided coherent selective pressures for the evolution of CCMs in the past, and resilience that will be required under future climatic conditions. For instance, to what extent is CAM and adaptation to rapid recharge and rehydration, rather than gradual metering of water use? To what extent did the availability of nitrogen, energetics of light use and hydraulic conductance drive C4 diversification? What might be the unintended consequences of introducing a CCM into higher plants for nitrogen use, resource partitioning and grain quality? Finally, from an overall food security perspective, we should perhaps consider the extent that food and clothing imports steal water, rather than carbon, from those parts of the world least able to waste such a limited resource.

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