THE
PLANT
CELL

Volume 32 Number 4 April 2020

The electronic form of this issue, available at www.plantcell.org, is the journal of record.

ON THE COVER

Climate change predictions point to an increased frequency and severity of drought in many of the most productive agricultural regions of the world. Plant scientists are therefore seeking novel methods to enhance plant water use efficiency. One option being explored is that of Crassulacean acid metabolism (CAM), a water-wise adaptation of photosynthetic CO_2 fixation. Research is underway to decipher the molecular-genetic blueprint for CAM in order to generate the parts list to facilitate CAM engineering into C_3 crops. CAM separates primary and secondary CO_2 fixation between the dark and light periods, respectively. Primary fixation in the dark is catalyzed by phosphoenolpyruvate carboxylase (PPC), followed by secondary CO_2 fixation by RuBisCO in the light. Boxall et al. (pages 1136-1160) generated transgenic RNAi lines of *Kalanchoë laxiflora* with reduced levels of the CAM-specific primary carboxylase PPC1. The most strongly silenced line lacked all detectable PPC activity, failed to fix atmospheric CO_2 in the dark period, and thus reverted to C_3-like photosynthetic metabolism. This had knock-on consequences for the operation of the core circadian clock and the regulation of guard cell signaling genes that are revealed as candidates for mediating the inverse pattern of stomatal opening and closing, relative to C_3 photosynthesis, which is characteristic of CAM. The cover image shows wild type *Kalanchoë laxiflora* in flower, along with the CAM performing succulent leaves below. In *K. laxiflora*, the endogenous circadian clock not only coordinates and optimizes CAM relative to the 24 h light/dark cycle, but also measures the changing seasons and signals flowering in response to short days. Photo by James Hartwell.

IN BRIEF

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RESEARCH ARTICLES

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The Plant Cell (eISSN 1532-298X) is published monthly (one volume per year) by the American Society of Plant Biologists, 15501 Monona Drive, Rockville, MD 20855-2768, and is produced by Dartmouth Journal Services, Waterbury, VT. The institutional subscription price is based on type of institution; contact institution@aspb.org. Members of the American Society of Plant Biologists may subscribe to *The Plant Cell* for $240. Nonmember individuals may subscribe for $500. Students may subscribe for $165. For matters regarding subscriptions, contact Suzanne Cholwek, ASPB, 15501 Monona Drive, Rockville, MD 20855-2768; telephone 301/296-0926; fax 301/251-6740; e-mail scholwek@aspb.org. Send all inquiries regarding display advertising to FASEB AdNet, 9650 Rockville Pike, Bethesda, MD 20814-3998; telephone 301/634-7791; fax 301/634-7153; e-mail adnet@faseb.org. The online version of *The Plant Cell* is available at www.plantcell.org.

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Plant Cell 2020;32;779-1336