

T H E
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ON THE COVER



White clover (*Trifolium repens*) is an allopolyploid legume found in temperate grasslands around the globe. It is also valued in agriculture as a high-quality animal feed and source of biologically fixed nitrogen. By contrast, the diploid progenitors of white clover are confined to extreme and specialized European niches: one is found in high alpine screes; the other on the coast within 100 m of the shore. Griffiths et al. (pp. 1466–1487) sequenced the genomes and transcriptomes of white clover and its progenitors to gain insight into the genesis of white clover and the consequences of allopolyploidization. These data confirmed the identity of the progenitors and revealed that white clover originated ~15–28,000 years ago during the last European glaciation when the alpine and coastal species would likely have been co-located in glacial refugia. This work highlights white clover as an example of allopolyploidy-facilitated niche-expansion, where two ancestor genomes, adapted and confined to very different and highly specialized environments, expanded to a global presence following merging during the last European glaciation. The photo shows white clover flowers in a glasshouse at AgResearch Grasslands, New Zealand. Photo credit: Sciencelenz, AgResearch.

The celebratory masthead artwork was designed by Ching-Yi Liao, a PhD student studying plant genetic and cell biology at Iowa State University (Ames). Currently, Liao is exploring the plant TOR-autophagy-regulated mechanisms and how plants use these mechanisms to adapt environmental changes. Before starting another new decade, let's thank *The Plant Cell* for providing a great place for great scientists! Follow Liao on Twitter (@jinslifexiv for artwork and @Jin_cyliao for science).

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Leung, K.P., Luo, M., Gao, C., Zeng, Y., Zhao, Q., Chye, M.-L., Yao, X., and Jiang, L. (May 23, 2019). Arabidopsis ENDOMEMBRANE PROTEIN12 contributes to the endoplasmic reticulum stress response by regulating K/HDEL receptor trafficking. *Plant Cell* <https://doi.org/10.1105/tpc.19.00421>.

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