EVOLUTION

Polyploid gains

The induction of polyploidy — that is, duplication or acquisition of entire sets of chromosomes — is a common event in the evolutionary histories of various species. The evolutionary consequences of polyploidization have mostly been inferred based on correlations with adaptive transitions during evolution. A new study uses experimental evolution in yeast to directly demonstrate that polyploidy can promote adaptation.

Selmecki *et al.* used strains of *Saccharomyces cerevisiae* that were haploid (1N), diploid (2N) or tetraploid (4N) but were otherwise isogenic. For each ploidy type, cells expressing either yellow fluorescent protein (YFP) or cyan fluorescent protein (CFP) were mixed at a 50/50 ratio and used to seed >170 replicate cultures. These cultures were monitored by flow cytometry for up to 250 generations to test how rapidly the strains adapted to the poor carbon source raffinose, as inferred by a skewing of the 50/50 colour ratio when a beneficial mutation arose and became positively selected in the cell population.

Overall, the tetraploid strains showed faster adaptation to this environment than the diploid or haploid strains. The authors' simulation analysis suggested that this was caused by beneficial mutations occurring at a higher frequency and with greater effects on fitness.

Consistent with these hypotheses, sequencing of the strains confirmed that the evolving tetraploid strains accumulated the most genetic diversity (comprising focal mutations up to gains or losses of entire chromosomes). Furthermore, the authors showed that introducing some of the identified beneficial mutation candidates into the initial strains provided the greatest selective advantage to tetraploid cells.

Such effects on adaptation might also be relevant to polyploid pathogens or cancer cells.

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ORIGINAL RESEARCH PAPER Selmecki, A. M. *et al.* Polyploidy can drive rapid adaptation in yeast. *Nature* http://www.dx.doi.org/10.1038/nature14187 (2015)