*Nature Reviews Genetics* | AOP, published online 24 June 2014; doi:10.1038/nrg3782

ChrisGorgio/iStock/Thinkstock

PLANT GENETICS

# Joining forces — asexual genome merger creates new allopolyploid species

> “new allopolyploid species can arise through asexual processes”

Allopolyploids contain sets of chromosomes that are derived from more than one species and are found among both wild and domesticated plants. This merging of nuclear genomes is a well-known source of evolutionary innovation, although it had been thought that allopolyploidization occurred only through hybridization events (that is, sexually) followed by genome duplication. Now, scientists from the Max Planck Institute of Molecular Plant Physiology have generated a new species of allopolyploid plant without sexual reproduction. “Our finding demonstrates that, contrary to common belief, new allopolyploid species can arise through asexual processes, and it provides us with a novel tool to generate new plant species, including novel crops,” says Ralph Bock, senior author of the study.

First, the researchers generated two transgenic plants with selectable marker genes — the hygromycin resistance gene *hpt* was introduced into *Nicotiana tabacum* and the kanamycin resistance gene *nptII* into *Nicotiana glauca*. The two transgenic plants were then grafted together, as grafting “is a very common type of plant–plant interaction in nature,” explains Bock. Successful grafting results in the fusion of tissues and the establishment of new vascular connections between the plants. Two to four weeks after fusion, tissue was taken from the contact zone and cultivated in the presence of both kanamycin and hygromycin so that only cells containing both of the resistance genes could survive. Resistant shoots were then grown to maturity. The researchers named this new species *Nicotiana tabauca*.

To confirm that resistance to both antibiotics occurred from the transfer of entire genomes and not from the transfer of the resistance genes only, the researchers used flow cytometry for DNA content analysis of *N. tabauca* cells and also fluorescence staining of the chromosomes. Notably, the genome size of the *N. tabauca* plantlets equaled the sum of the genomes of *N. tabacum* and *N. glauca*; that is, a total of 72 chromosomes (48 from *N. tabacum* and 24 from *N. glauca*) were present. Analysis of several of the *N. tabauca* plants revealed that none were heteroplasmic for the progenitor plastid genomes, which indicates that the transfer of the nuclear DNA probably occurred through the migration of nuclei from cell to cell rather than through the fusion of cells at the graft site. Some *N. tabauca* traits were inherited directly from the progenitor species (such as a lighter green leaf pigmentation from *N. tabacum*) and other traits (such as leaf shape) were intermediate. Interestingly, *N. tabauca* grew at a greater rate than the two progenitor species.

This work shows that entire nuclear genomes can be transferred between plant cells and that new species can be generated asexually. Future work built on this research might shed light on whether this process has occurred in nature and could also lead to the generation of new crops. The fact that this transfer of entire nuclear genomes can occur through grafting between very different species “further blurs the boundary between man-made genetic engineering and genetic engineering made by mother Nature,” adds Bock.

*Bryony Jones*

**ORIGINAL RESEARCH PAPER** Fuentes, I. *et al.* Horizontal genome transfer as an asexual path to the formation of new species. *Nature* http://dx.doi.org/10.1038/nature13291 (2014)