ARCHAEA

Breaking down the species barrier

Like bacteria, archaea reproduce asexually and can exchange DNA through lateral gene transfer (LGT). Distinct lineages or 'species' are maintained owing to the presence of barriers to LGT, such as geographic isolation, genetic incompatibility or physical restraints on DNA transfer. However, writing in *Current Biology*, Naor *et al.* now show that halophilic archaea can form interspecies cell fusions that enable homologous recombination between distinct species.

Cells of the archaeon *Haloferax volcanii* can fuse to form a heterodiploid, providing an opportunity for homologous recombination to occur between the two chromosomes before the cells separate to form haploids again. This process can occasionally result in the formation of hybrids of the parent strains. Interestingly, previous studies have shown that *H. volcanii* can exchange plasmids with *Haloferax mediterranei*, although the mechanism behind this exchange was unclear. To test whether the two species can form interspecies heterodiploid fusions, the authors carried out mating experiments between a *trpA*$^-$ strain of *H. mediterranei* and an *hdrB*$^-$ strain of *H. volcanii* (lacking Trp synthase α-chain and dihydrofolate reductase, respectively), and then plated the cells on medium lacking Trp and thymidine to select for heterodiploids. Using either a PCR-based approach or a plasmid-based assay to monitor the ploidy of the resultant cells, the authors found that interspecies fusions occurred at a frequency that was within one order of magnitude lower than the frequency of intraspecies fusions between *H. volcanii* cells, suggesting that such events are relatively common. Interspecies fusion overcomes the physical barrier to LGT, so the authors sought to investigate whether homologous recombination occurs between the two chromosomes in the heterodiploid. They observed that ~8% of the haploid progeny of the interspecies heterodiploids were *trpA*$^+$*hdrB*$^+$, indicating that homologous recombination between the chromosomes is a fairly frequent event. Genome sequencing revealed that each hybrid contained a single large *H. volcanii* chromosomal fragment ranging in size from 310 kb to 530 kb, with the remainder of the genome coming from *H. mediterranei*. Interestingly, most of the sites of recombination appeared to be nonrandom, with sequence identity at these sites being higher than the average 86.6% nucleotide sequence identity observed in the coding regions of the genes shared between the two species. In particular, two of the recombination sites coincided with tRNA genes that are highly conserved between the two species.

Taken together, these findings suggest that the physical and genetic barriers to LGT between *Haloferax* spp. are fairly low and that geographical factors may therefore have a more important role than these other barriers when it comes to speciation of halophilic archaea.

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ORIGINAL RESEARCH PAPER Naor, A. *et al.* Low species barriers in halophilic archaea and the formation of recombinant hybrids. *Curr. Biol.* 28 Jun 2012 (doi:10.1016/j.cub.2012.05.056)

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> "Interspecies fusion overcomes the physical barrier to LGT"