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Digest: Biased male–male competition drives asymmetric introgression in lizards*

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Introgression, gene flow from one population into another, can be asymmetric. Yang et al. suggest that reduction of gene flow in one direction, rather than elevated gene flow in the opposite direction, explains the pattern of asymmetric introgression between two lizard lineages. The authors propose that a dominant male phenotype in one lineage blocks a submissive male phenotype from another lineage in mating with females of the opposite lineage. This case underscores just how capricious introgression can be.

At hybrid zones, distinct populations can exchange genes, while maintaining their overall genetic integrity; a process known as introgression (Mallet 2005). Often introgression is asymmetric, with gene flow being biased toward one of the two populations involved. On the one hand, this asymmetry could reflect elevated gene flow in one direction. Under hybrid zone movement, selectively neutral alleles of the retreating population are predicted to be left behind in the expanding species. Such movement, and the associated neutral introgression, may be a more common feature of hybrid zones than generally appreciated (Wielstra 2019). Introgression can also be adaptive: an allele that evolved in one population might be superior and, when brought into the other population by backcrossing, would then outcompete the native allele (Barton 2001). This would be difficult to observe in nature, considering that fixation should be reached relatively quickly compared to the length of time that hybrid zones have typically existed.

On the other hand, asymmetry in introgression may indicate gene flow being reduced into one direction, if, for example, hybridization involves asymmetric mate choice or biased survival of reciprocal-cross hybrids. In this issue, Yang et al. (2020) present a case in which the skewed outcome of competition between males of two lineages of the common wall lizard (*Podarcis muralis*) curbs gene flow into one direction. The authors studied a hybrid zone in north-western Italy between the so-called Italian and Southern Alps lineages. They sampled a coastal transect, in which the Italian lineage has evolved a male phenotype that is dominant over the Southern Alps lineage, and an inland transect, in which the Italian lineage lacks this dominant phenotype. Although in the inland transect introgression is roughly equal in both directions, in the coastal transect introgression into the Italian lineage is considerably reduced.

A particular strength of the wall lizard system is that common garden experiments involving experimental hybridization have provided considerable insight into mate choice and intrasexual competition (e.g., While et al. 2015). The females are not particularly picky. However, the dominant (Italian) males do limit the mating opportunities of the submissive (Southern Alps) males. Yang and colleagues attribute the observed introgression pattern to this asymmetric outcome of male–male competition: the Italian lineage can resist introgression along part of the hybrid zone due to the local presence of the dominant male phenotype.

The wall lizard case underscores that individual hybrid zones behave in idiosyncratic ways when it comes to introgression. Furthermore, even at multiple points along the same hybrid zone, genome-wide patterns of gene flow can differ dramatically. As "natural laboratories for evolutionary studies" (Hewitt 1988),

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hybrid zones have taught us that introgression can be caused by many factors. Yang et al. (2020) show that unraveling the drivers of introgression requires a detailed understanding of the natural history of the taxa under study.

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