Nature Reviews Genetics | AOP, published online 3 November 2009; doi:10.1038/nrg2705

SPECIATION

New insights into hybrid sterility

Speciation occurs when populations accumulate genetic differences that lead them to become reproductively isolated. Although many loci involved in reproductive incompatibility have been identified, the underlying biological mechanisms have remained elusive. Now, the first steps of a mechanism for hybrid sterility have been characterized in *Drosophila* species, suggesting a role for the evolution of heterochromatic regions in this process.

Crosses between *Drosophila simulans* and *Drosophila mauritiana* flies result in F_1 hybrid male sterility — caused by the *Odysseus-site homeobox* (*Odsh*) gene, which is expressed in fly testes. Bayes and Malik examined the localization of labelled forms of the two ODSH proteins (ODSHsim and ODSHmau) in *D. simulans* embryonic cell culture. They found that both ODSHsim and ODSHmau associated with heterochromatic repeat-rich regions of the *D. simulans* genome — the X pericentric region and the fourth chromosome — but, in addition, ODSHmau localized to the Y chromosome.

Using whole-mount immunohistochemistry to look at endogenous ODSH localization in *D. simulans*, Bayes and Malik found that ODSH expression was restricted to developing post-mitotic primary spermatocytes in the G2 phase of the cell cycle. In a sterile *D. simulans–D. mauritiana* introgression line, there was increased ODSH expression the late G2 spermatocytes, which is consistent with increased ODSH expression in the testes of these flies. By contrast, in a fertile introgression line and in *D. mauritiana* there was no ODSH expression in the testes, indicating that there are differences in ODSH levels and localization between *Drosophila* sibling species and between the sterile and fertile introgression lines.

Could the differences in ODSH expression and localization explain hybrid sterility? The authors also found that ODSH binding leads to heterochromatin decondensation in hybrids. Although it is currently unclear how the additional binding of ODSHmau to the Y chromosome affects sperm development, these results suggest that decondensation of heterochromatic repeat-containing regions is involved in this *Drosophila* hybrid sterility phenotype. The authors suggest that the genetic conflict that arises between host organisms and rapidly evolving DNA repeat elements might be an important evolutionary force in hybrid incompatibility. This is particularly interesting in light of recent findings that other loci that encode DNA-binding proteins and satellite repeats might contribute to hybrid dysfunction.

Meera Swami

ORIGINAL RESEARCH PAPER Bayes, J. J. & Malik, H. S. Altered heterochromatin binding by a hybrid sterility protein in *Drosophila* sibling species. *Science* 22 Oct 2009 (doi:10.1126/science.1181756)