

EVOLUTION

Gene duplicate holds back its sister

Gene duplication followed by the emergence of a new function in one copy is an important source of evolutionary novelty. However, little is known about the effects that a new function can have on the evolution of other genes. A recent study in

honeybees addresses this question, showing that neofunctionalization in one gene of a paralogous pair can restrict the evolution of its sister copy.

In the honeybee (*Apis*) lineage a tandem duplication of the *feminizer* (*fem*) gene has given rise to the paralogous gene *complementary sex determiner* (*csd*). Whereas *fem* has maintained its original function in sex determination, *csd* has evolved a new function to become an initiating signal in the sex determination pathway.

Hasselmann and colleagues compared the ratio of non-synonymous (n) to synonymous (s) mutations in *fem* in two contexts: in *Apis* species, which have both *fem* and *csd*, and in other bee species that have *fem* only. The n/s ratio was significantly lower in the *Apis* lineage, which suggests that *fem* has been subject to increased purifying selection — that is, mutations that affect the function of *fem* have been selected against. Hasselmann and colleagues ruled out

the alternative possibilities that the rate of synonymous substitution had increased in *fem* genes of *Apis* bees, or that the genetic linkage between *fem* and *csd* caused the reduced rate of *fem* evolution.

Because *fem* and *csd* function in the same pathway, an attractive explanation for the limited evolution of *fem* when *csd* is present is that changes in the FEM protein would disrupt the function of CSD. As well as prompting similar investigations of other paralogous gene pairs, this study highlights more generally the need to look at the effects of newly evolved functions on the evolution of other genes.

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ORIGINAL RESEARCH PAPER Hasselmann, M., Lechner, S., Schulte, C. & Beye, M. Origin of a function by tandem gene duplication limits the evolutionary capability of its sister copy. *Proc. Natl Acad. Sci. USA* **107**, 13378–13383 (2010)
FURTHER READING Soskine, M. & Tawfik, D. S. Mutational effects and the evolution of new protein functions. *Nature Rev. Genet.* **11**, 572–582 (2010)