EVOLUTION

Young genes are essential too

GETTY

The traditional wisdom in evolutionary genetics is that essential genes are usually the older ones that have been maintained over long evolutionary time frames. Two studies of young genes in species of *Drosophila* reveal that in fact essential genes are just as likely to be young, and that new genes can quickly integrate themselves into key pathways to take on essential roles.

Chen and colleagues used the whole-genome sequences for 12 closely related species of *Drosophila* to identify 566 young *Drosophila melanogaster* genes that have originated within the past 35 million years. By making lines in which young genes are targeted by RNAi the authors showed that ~30% are essential for viability. This proportion is close to that estimated for all genes in *D. melanogaster*. Furthermore, the time of origin of the young essential genes was spread evenly across the 35 million years, suggesting that essentiality is independent of age.

How do young genes become essential? Chen and colleagues found that most of the young essential genes that they studied have crucial functions during larval and pupal development. Knocking down the expression of these genes led to the termination of distinct developmental processes and morphological defects. These genes also show signs of adaptive evolution, and the authors propose that new genes integrate into existing developmental pathways and undergo mutation and selection that leads to their essentiality and gives rise to new developmental programmes.

Another study provides a detailed example of how a young gene has evolved an essential role in this way. Ding and colleagues studied young genes that originated between 5.4 and 12.8 million years ago in a common ancestor of *D. melanogaster* and closely related species through duplication of a parental gene, *kep1*, which has roles in female fertility, eye development and immunity. One of the three new duplicate genes, *nsr*,

shows signs of adaptive evolution, and knocking it out resulted in severe defects in sperm development. Furthermore, *nsr* seems to have evolved a role in the regulation of Y-chromosome-linked fertility genes involved in sperm maturation, thus integrating a new function into an existing developmental pathway.

Together, these findings should provoke a shift in the way the evolution of new genes and essential functions is studied. They also have important implications for areas such as genome annotation, where a greater functional importance of older genes is often assumed.

Louisa Flintoft

ORIGINAL RESEARCH PAPERS Chen, S., Zhang, Y. E. & Long, M. New genes in *Drosophila* quickly become essential. *Science* **330**, 1682–1685 (2010) | Ding, Y. et al. A young *Drosophila* duplicate gene plays essential roles in spermatogenesis by regulating several Y-linked male fertility genes. *PLoS Genet.* **6**, e1001255 (2010)