



Image courtesy of R. Libbrecht, University of Lausanne, Switzerland, and Y. Wurm, Queen Mary, University of London, UK.

## GENOME EVOLUTION

# The social chromosome

Insects are well-known for having complex social organizations, and some species have several distinct social forms. In a study of fire ants, researchers have now discovered that a chromosome with similar properties to the Y and W sex chromosomes is responsible for divergent social forms.

The fire ant *Solenopsis invicta* has monogyne and polygyne social forms, in which colonies have a single queen or multiple queens, respectively. A single genomic element — marked by the gene *Gp-9* — determines the social form: colonies with only *Gp-9BB* workers accept only one queen (with the *Gp-9BB* genotype); colonies with *Gp-9BB* and *Gp-9Bb* workers accept multiple *Gp-9Bb* queens; and the *Gp-9bb* genotype is lethal.

It has been suggested that *Gp-9* might be part of a ‘supergene’ comprised of many genes in tight

linkage, and Wang *et al.* investigated this idea using restriction-site-associated DNA (RAD) sequencing (RAD-seq) to generate genetic maps of haploid male offspring from *Gp-9BB* and *Gp-9Bb* queens. These maps revealed a ~13 Mb region linked to *Gp-9* in which recombination is suppressed. This region makes up ~55% of a chromosome, and the authors term the two forms of this chromosome social B (SB) and social b (Sb).

The authors found that the basis for the suppression of recombination is a large chromosomal inversion. In addition, they showed — using gene expression data — that most of the phenotypic differences between the two social forms result from differences in the non-recombining regions.

The Sb chromosome shares several characteristics with

sex-limited chromosomes, such as the Y chromosome. In addition to the suppression of recombination, Y chromosomes accumulate deleterious mutations. As Sb/Sb individuals are non-viable, this shows that the Sb chromosome harbours at least one lethal mutation, and Wang *et al.* also found increased numbers of repetitive elements on the Sb chromosome. However, because genes on the social chromosome are expressed in haploid males, it seems that purifying selection does act on this chromosome, thus slowing down its degeneration (compared to Y chromosomes, which are usually silenced in haploid sperm).

‘Supergenes’ might turn out to be a more widespread feature of social polymorphisms, and studies of these social chromosomes could also be informative for understanding sex-chromosome evolution.

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A Y-like social chromosome causes alternative colony organization in fire ants. *Nature* 16 Jan 2013  
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