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Sex and the honeybee

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In the **haplodiploid** insect order Hymenoptera, males are derived from haploid unfertilized eggs and females from fertilized diploid eggs. In the August 22 *Cell*, Martin Beye and colleagues from Biozentrum at **Martin-Luther-Universitat** report the identification of the primary sex-determining signal in honeybees. This signal encodes a product that triggers the female developmental pathway if it results from two different alleles in females, but the product is inactive if it results from two identical alleles or a single allele in males, allowing the default male developmental pathway. This phenomenon is known as complementary sex determination - hence, the *csd* gene (*Cell* 2003, **114**:419-429).

Beye *et al.* identified genetic markers that flanked the sex-determining locus and by chromosome walking and fine mapping located a single gene that was always heterozygous in females. The ~5-kb region containing it was cloned, sequenced, and analyzed for exon-coding regions. These were assembled into the 1453-bp *csd* sequence consisting of nine exons that contained an open reading frame of 385 amino acids. Sequence comparisons revealed the protein to be an arginine-serine (RS) -rich protein that was similar to the *tra* genes of Dipteran insects, representing a distinct member of a gene family that has RS domains, which is involved in pre-mRNA splicing and metabolism. Repression of *csd* translation by RNA interference demonstrated its key role in sex determination in the honeybee.

"As CSD has no RNA binding domain, we propose that a factor with RNA binding function exists in the honeybee that cooperatively binds with CSD and mediates RNA splicing... The *Apis* system appears to be the most ancient and the simplest system studied so far," the authors conclude.

References

1. Gene flow and selection balance in haplodiploid social insects
2. *Cell*, [<http://www.cell.com/>]
3. Biozentrum, Martin-Luther-Universitat, [<http://www.biozentrum.uni-halle.de/>]