

## **P045** Why Mendelian segregation?

**Francisco Úbeda and David Haig**

*St. John's College and Oxford Centre for Gene Function, Oxford University; Department of Organismic and Evolutionary Biology, Harvard University*

Since the rediscovery of Mendel's experiments in peas, the default assumption in genetics is that the two alleles at a heterozygous locus are each transmitted to half of an individual's functional gametes. This expectation has been formalized as Mendel's first law of equal segregation. However, this law cannot be a fundamental constraint on the nature of genetic systems because loci are known at which one of the alleles is transmitted to more than fifty per cent of offspring. Such examples of 'meiotic drive' raise the question of why fair segregation is the rule and segregation distortion the exception, rather than the other way round. Many explanations have been proposed and discarded, in the knowledge that a new explanation would be needed. The explanation prevailing today relies on the simplifying assumption of equal segregation in the two sexes. Evidence from natural systems fails to support this assumption and justifies our work on an extended model that allows differential segregation distortion in each sex. We show that natural selection favours departure from Mendelian expectations, leaving fair segregation, once more, bereft of theoretical justification. This is not the case if segregation distortion is limited to one sex but not to the other. In addition, by establishing conditions that favor departure from fair segregation, we provide a path for the evolution of the segregation schemes observed in permanent translocation heterozygotes.