chromosomal changes have all occurred within the 1,000 years since their ancestors arrived on the island, possibly on Viking ships. The so-called Robertsonian (Rb) fusions that led to these rapid karyotype changes are relatively common chromosomal rearrangements. But their accumulation in the populations of Madeira Island and in multiple other isolated mouse populations elsewhere is likely due to another influencing factor: the preferential segregation of the Rb fusion into the egg rather than into the discarded polar bodies that form during female meiosis.

We usually think of the chromosome segregation machinery as ensuring unbiased, random segregation. As we learn in high school biology, if a diploid individual carries two different alleles of a gene (i.e., is heterozygous), then either allele is equally likely to end up in a haploid gamete. This law explains the 3:1 ratio of phenotypes that Mendel observed in his classic studies of heredity. Scientists have known for decades, however, that selfish genes can subvert Mendelian segregation to increase their frequency in the next generation, a phenomenon known as meiotic drive. The Madeira mice suggest that fusion chromosomes can also drive unequal inheritance.

Because Rb fusions are easy to identify morphologically, and because mouse oocytes are an established model system, studying these fusions in mice provided an entry for my lab at the University of Pennsylvania to investigate the cell biology of meiotic drive, starting in 2010. Focusing on the centromere—the part of each chromosome that interacts with spindle microtubules to direct segregation in mitosis or meiosis—we found that the structure’s size determines the direction of biased segregation, with bigger centromeres preferentially segregating into the egg. Centromere DNA is typically highly repetitive, and we found that larger centromeres have more of the satellite repeats characteristic of mouse centromeres and more centromere proteins associated with that DNA. Thus, it seemed that newly formed Rb fusions could result in larger centromeres that would drive and become fixed in natural populations.

Meiotic drive of Rb fusions illustrates an idea proposed more than 50 years ago in a paper by zoologist Michael J. D. White: “It may be