A prototype gene drive to suppress invasive mice on islands

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Abstract

Invasive rodents are a major cause of environmental damage and biodiversity loss, particularly on islands. Population-suppressing gene drives with biased inheritance have not previously been developed in any vertebrate system. We have recently developed a mouse gene drive prototype (t_{CRISPR}) that leverages super-Mendelian transmission of the *t* haplotype to spread inactivating mutations in a haplosufficient female fertility gene (*Prl*). Spatially explicit individual-based *in silico* modeling shows that t_{CRISPR} can eradicate island populations under a range of realistic field-based parameter values. We also engineer transgenic t_{CRISPR} mice that, crucially, exhibit biased transmission of the modified *t* haplotype and *Prl* mutations at levels our modeling predicts would be sufficient for eradication. Our next step is to develop a proof-of-concept laboratory mouse that targets a gene carrying a sequence variant that is locally fixed within a target island population, but is found only at low to intermediate frequencies in non-target populations. We are also discussing with Australian regulators strategies for testing such a prototype mouse first in laboratory cages, then in contained field pens, to determine whether it behaves as predicted under semi-field conditions.

Key words: mouse, gene drive, genetic control, locally fixed alleles