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Genetically explicit model may explain multigenerational control of emergent Turing patterns in hybrid *Mimulus*

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The origin of phenotypic novelty is a perennial question of evolutionary genetics. Phenotypic novelty is an essential aspect of both adaptive evolution and intergenerational phenotypic change. To date, there are few studies of biological pattern formation that specifically address multigenerational aspects of inheritance and phenotypic novelty. For quantitative traits influenced by many segregating alleles, offspring phenotype is often intermediate to parental values. In other cases, offspring phenotype can be transgressive to parental values. For example, in the model organism Mimulus (monkeyflower), offspring of parents with solid-colored petals exhibit novel spotted petal phenotypes. Previous research shows that these patterns are controlled by a gene regulatory network that subserves Turing-type pattern formation. It is known that this gene regulatory network is controlled by a small number of loci. In this work we develop and analyze a hierarchical model of pattern formation, its underlying regulatory network, and the genetics of inheritance. The model gives insight into how non-patterned parent phenotype can yield phenotypically transgressive, patterned offspring. Using recombinant inbred lines, we hope to identify the mechanism that is responsible for the transgressive petal phenotypes that we observe in Mimulus.