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The genetics of evolutionary adaptations to abiotic and biotic stresses

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The Genetic and Physiological Basis of Adaptation to Divergent Habitats

Studies of natural variation underlying organismal adaptations to contrasting habitats provide excellent opportunities for understanding the genetic basis of stress tolerance. My research focuses on the genetic and physiological basis of adaptation of the yellow monkeyflower, *Mimulus guttatus*, to coastal and inland habitats. I have recently identified the key environmental factors and genetic mechanism responsible for adaptation in this system. Inland *Mimulus* plants allocate resources primarily to growth and rapid reproduction to escape from seasonal drought while investing little in constitutive defense against herbivores. In contrast, coastal plants invest more heavily in defense and have evolved a slower-growing later flowering life-history as a result of year-round soil water availability. My current research suggests that this adaptive growth-defense trade-off is at least partially the result of the evolution of multiple gibberellin genes. One of these genes, *GA20ox*, is located within an adaptive chromosomal inversion, which is responsible for developmental divergence between coastal and inland plants. Further, population genomic analyses and gene-regulatory studies conducted in nature have identified major candidate genes underlying the greater tolerance of coastal plants to oceanic salt spray. Overall, these results provide new insights into the evolution of adaptations and illuminate fundamental trade-offs that have implications for agriculture.