Transcending Plant-Herbivore Interactions in the Time of Omes

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The identification of the physiological mechanisms that govern diet selection in mammalian herbivores has been a central focus of many studies. For decades the initial investigations into this question were organismal in approach; only recently have molecular and genomic techniques been applied to studies of mammalian herbivores. While reductionist studies have been of critical importance in identifying candidate mechanisms, the demonstration that these possible mechanisms are indeed responsible for dictating diet selection requires scaling back up to the whole organism level. We have been taking an integrative approach that combines whole organism and molecular studies to understand the physiological mechanisms that govern the foraging behavior of a herbivorous mammal, the desert woodrat. Our whole organism studies document differential capacities for ingestion of toxic diets (creosote resin) in populations that differ in their evolutionary experience with this toxin. Molecular assays (e.g., microarrays, gene cloning, sequencing) have revealed candidate genes (e.g., cytochrome P450 2B) that may be responsible for detoxification differences between populations. We are currently applying functional assays to validate candidate genes. We will use our experience in this system to outline a protocol for identifying evolutionary adaptations in non-model species using a functional genomics approach.