Dissertation Research Abstract

Macroevolution in a changing Australia

Changes to the global climate can promote macroevolutionary and macroecological turnover by either abiotic or biotic drivers, or both. Climatic changes may proceed over long or short time periods, varying in intensity from mild to extreme, and as a result, changes to macroevolutionary patterns may respond in kind. It remains unknown however, how *predictable* organismal responses may be, particularly across ecologically diverse groups. My dissertation research has largely focused on how changing environments have impacted the accumulation of diversity of Australian vertebrates since the continent's isolation ~35 million years ago.

The Miocene epoch (23–5.3 Ma) has reportedly figured prominently in the diversification of many extant faunal groups. This is likely the result of climatic instability, fluctuating atmospheric CO_2 concentrations and floral biome turnover. Across the globe, Late Miocene cooling coincided with the birth and expansion of arid biomes and contraction of more mesic ones, as C3 forest and woodland plants were replaced by C4 savannah and grasslands. In Australia, this resulted in a dramatic restructuring of habitats, transitioning the continent from warm wet forests, to the barren red sands of today's "Outback". To investigate this idea, we can search for signature of these climatic shifts in the evolutionary history of Australia's animals.

To test for signal from empirical data, I employed phylogenetic comparative methods to link diversification patterns with climate-dictated processes. Given a set of taxa and tissue samples, we produced genetic data via traditional Sanger-sequencing and exon-capture methods. This allowed us to infer relationships among the sampled taxa, providing a phylogenetic framework. Using these phylogenies, we investigated (**1**) rates and trends in speciation and extinction, (**2**) biogeographic histories including trends in the prevailing geographic mode of speciation, and (**3**) the evolution of organismal traits. Our findings suggest that heterogeneity in the diversification of Australian animals has been largely dictated by biome restructuring through the Miocene and Plio-Pleistocene. This is evident by (**1**) increased speciation in arid and dispersal back into mesic habitats, (**2**) increased allopatry as a result of fracturing mesic habitats, and (**3**) decreasing rates of phenotypic evolution due to niche conservatism. We provide evidence that broad abiotic and biotic influences can result in similar patterns across cohabiting groups with disparate ecologies. While Australia is unique in its forms of diversity, its biogeographic and phenotypic patterns have probably been shaped by the same processes occurring elsewhere.