Adaptive Radiations

Adaptive radiations - prevalent theme on islands

- one of several processes that promote increased diversity in one lineage relative to a sister group

One lineage (clade 2) is more diverse due to combination of species radiation and adaptation into many ecological zones - perhaps due to the origin of a novel feature (key innovation) or open niches on islands.
Adaptive Radiations

"... species occasionally arising after long intervals in a new and insulated district, and having to compete with new ancestors, will be especially liable to modification, and will often produce groups of modified descendants."

Darwin’s finches

Adaptive Radiations

Osborn (1900)

“... an isolated region, if large and sufficiently suited in its topography, soil, climate and vegetation, will give rise to a diversified fauna according to the law of adaptive radiation from primitive and central types. Branches will spring off in all directions to take advantage of every possible opportunity of securing food.”

Adaptive Radiation - the rise of a diversity of ecological roles and attendant adaptations in different species within a lineage (Givnish 2015)

Adaptive Radiations

The study of adaptive radiations - one problem!

. . . as this field involves issues of both phylogenetics and ecological modification . . .

Adaptive Radiations

The study of adaptive radiations - one problem!

. . . telling the adaptive story of beak size, structure, function is often done using relationships based on these morphological features

Circular reasoning?
Adaptive Radiations

The study of adaptive radiations - one problem!
- molecular phylogenetics critical

How morphology can be misleading - especially in "island" settings -
Divergence: changes in homologous structures among related species; changes permit each species to specialize in different environments
Convergence: changes in analogous structures among unrelated species; changes permit each species to specialize in the same environment

Rands et al. BMC Genomics 2013 14:95

Darwin’s finches - what we now know based on molecular phylogenetics

Lamichhaney et al. Nature 2015

- hybridization & introgression
- species can be messy!
Adaptive Radiations

We will examine adaptive radiations, in the context of the Hawaiian Islands.