Directionality of these evolutionary patterns can be assessed with unusual confidence because of the close relationship of silversword alliance species to extant members of their ancestral _Malacarthallardiiopsis_ lineage in California. Available evidence strongly suggests that (1) the silversword alliance is monophyletic; (2) _Dubautia_ species with 13 pairs of chromosomes, which are found on all but the oldest of the high Hawaiian islands, were derived from species with 14 pairs of chromosomes, which are centered on the oldest high island, Kauai; (3) a general pattern of species migration from west to east, i.e., from older to younger islands, prevails within the largest genus, _Dubautia_; and (4) hybridization has affected observed patterns of relationship. Although the weight of evidence suggests an origin of the silversword alliance on Kauai or an older, now extinct island, the restriction of _Argyrotrichium_ to the young islands of Maui and Hawaii presents a biogeographic enigma.

358 CARSON, HAMPTON L. Genetics Department, University of Hawaii, Honolulu HI 96822. - _Introduction to the biogeography of the Hawaiian Islands._
A well-documented tectonic theory states that each island of the archipelago has been formed over a hotspot in the earth's mantle. Lava forms an island by perforating and then riding on the Pacific plate, which is currently moving northwest at the rate of about 9 cm per year. Thus each of the 8 newest high islands was formed successively and all continue to drift to the northwest. Kauai is the oldest (5.1 myr) whereas Hawaii at the southeast end of the archipelago is the youngest (<0.5 myr). Most of the endemic terrestrial biota appears to have been ultimately derived from waifs arriving from continental sources. The older low eroded islands to the northwest of Kauai may have been a source of founders for populations colonizing the newer high islands. Genetic tracing of the origins of endemic species on the newer islands shows that exuberant speciation has occurred successively from the older to the newer islands. This suggests a key role for a succession of founder events and small population effects in the development of the biota.

359 DE SALLE, R. Department of Entomology, American Museum of Natural History, New York, NY 10024. - _The intra- and inter-island relationships of Hawaiian Drosophila deduced from DNA sequence information._
The phylogenetic relationships within several species complexes and subgroups of Hawaiian _Drosophila_ are examined using DNA sequence data. Several nuclear and two mitochondrial genes are used to infer phylogenetic relationships in the _planitibia_ subgroup, the _Antopocerus_ species group, the _grimshawi_ complex and the _adiastola_ subgroup. Outgroups are carefully chosen to polarize relationships within these clades. Two types of distributional questions are addressed using these relatively closely related taxa. The first question involves the examination of phylogenetic patterns within a particular island (Hawaii) or island complex (Maui Nui). The second question concerns the phylogenetic distribution of taxa between islands and island complexes and addresses the possible corellation of phylogenetic derivedness with newer islands in the Hawaiian archipelago.

360 GANDERS, FRED R.*, Department of Botany, University of British Columbia, Vancouver, B. C., Canada V6T 1Z4, and VICKI A. FUNK, Department of Botany, Smithsonian Institution, Washington, D. C. 20560. - _Phylogeny, biogeography, and evolution of Hawaiian Bidens._
The continental sister group of the Hawaiian species of _Bidens_ is section _Greenmania_, which occurs from Mexico to Brazil. The 27 endemic Hawaiian taxa of _Bidens_ evolved from a single
colonizing species. Evolutionary divergence among the Hawaiian taxa has primarily involved morphological and ecological characters, with little or no differentiation in secondary chemistry, isozymes of primary metabolism, or chromosomes. Most major clades originated on (or possibly prior to the emergence of) Kauai. Speciation has usually followed colonization of a younger island or volcano. Successful interisland colonization has been infrequent, and most taxa are single island endemics. Subspeciation has taken up to 0.4 million years, and speciation 0.4-1.3 million years or more. Parallel colonization of younger islands by most major clades is responsible for the diversity of species on younger islands. Intraspecific speciation has occurred only on islands or volcanoes as old or older than West Maui. Gynodioecy probably evolved only once in Hawaiian Bidens, but is found on all major islands. Gynodioecy is correlated with drier habitats and with inferences of numerous, small heads, probably because geitonogamous self pollination is more likely in such inflorescences.

361 GILLESPIE, ROSEMARY G.* AND HENRIETTA B. CROOM. Department of Zoology, University of Hawaii, Honolulu, HI 96822 and Department of Biology, The University of the South, Sewanee, TN 37375. - Pattern and process in speciation: A comparative approach using a Hawaiian spider radiation. Speciation is fundamental to evolutionary biology, yet the processes involved remain enigmatic. At the basis of the problem is the necessarily heavy reliance on inference, as it is rarely possible to find systems which are amenable to both generating and testing phylogenetic hypotheses. We have recently discovered a large species radiation of spiders of the genus Tetragnatha in the Hawaiian Islands that presents a unique opportunity for analyzing the process of species formation. Preliminary phylogenetic analysis, using both morphological and molecular information, has allowed us to generate hypotheses regarding the mechanism of speciation within a clade. We are currently testing these hypotheses using contrasts provided by different groups within the lineage to determine the interaction between ecological affinities and species formation. In particular, groups differ in terms of habitat specialization, allowing comparative analysis to test theories as to the interaction of habitat specialization and mechanism of speciation. We are addressing two primary questions: (1) Are the characters responsible for initiating divergence among populations ecological or sexual in nature? (2) Among this spider lineage, do habitat specialist groups differ from habitat generalists in their biogeographic pattern of phylogeny? Current theory would predict that habitat specialists may be capable of parapatric speciation through the operation of disruptive selection, while habitat generalists require strict allopatry.

362 GIVNISH, THOMAS J.*, KENNETH J. SYTSMAN, JAMES F. SMITH, AND WILLIAM J. HAHN. Department of Botany, University of Wisconsin, Madison WI 53706. - Molecular evolution, adaptive radiation, and geographic speciation in the endemic Hawai’ian lobelioid genus Cyanea. Cyanea (Lobelioideae) is the second largest genus of flowering plants endemic to Hawai’i, and has undergone a remarkable series of adaptive radiations in growth form, leaf shape, and floral morphology. It provides superb material for studying patterns of geographic speciation because most of its species are restricted to single islands. We conducted a nested analysis of phylogenetic relationships within the Hawai’ian lobeloids based on restriction site variation in cpDNA, showing that Clermontia is the sister group to Cyanea, and that Cyanea includes Rollandia (endemic to O’ahu) as a subclade. A cladistic analysis of relationships within Cyanea reveals (i) a strong tie to the geography and history of the archipelago, with basal species largely endemic to the oldest current island, Kaua’i; (ii) at least 10 inter-island dispersal events, mostly between adjacent islands; (iii) several speciation events within individual islands; and (iv) an origin on an island much older than Kaua’i. We hypothesize that Cyanea’s greater tendency to speciate – and its greater susceptibility to extinction – compared with Clermontia is a result of lesser powers of dispersal, due to its smaller fruits and reliance on avian frugivores of forest interiors.