

## PROJECT SUMMARY

**Intellectual Merit:** Our project examines the impact of geological and climatic events on the evolutionary history of animal and plant species in Patagonia (southern South America). Unlike other parts of the world (e.g., North America and Europe) very little is known about the role of historical events—such as glacial cycles, mountain building, and river captures—on the speciation and demographic histories of Patagonian species. This intellectual void restricts our understanding of the processes responsible for generating biological diversity in temperate South America and limits current conservation efforts. What is needed is a broad survey of the evolutionary histories of several taxonomically distinct species (or species complexes) distributed across Patagonia, an effort that will require a strong international partnership.

Our project is important at several levels. First, it will provide the only *comparative* molecular-based framework for scientists worldwide to understand the interplay between past historical events and the distribution and abundance of Patagonian species. Second, by focusing our efforts across a variety of co-distributed taxa (fish, lizards, frogs, crustacea, and land plants), our work will allow tests for congruent effects on distinct species that occupy similar ranges, and for disjunct effects on species with different ecological attributes (e.g., aquatic versus terrestrial species, mobile versus sessile taxa, etc.). Third, given the current scarcity of data-based biogeographical hypotheses for Patagonia, we will also employ innovative statistical techniques in nested clade analysis to generate and test new hypotheses.

Our project will focus on reconstructing phylogeographic histories of at least 16 distinct species (or species complexes) that occupy the Patagonian region of southern Argentina and Chile. We will use molecular markers (mtDNA and nuclear DNA sequences and microsatellites) and morphometric data to reconstruct population histories of three fish species, two large complexes of lizard species, two frog species, two freshwater crab species, and two plant species. The latest comparative phylogeographic methods will be used to test for congruent historical patterns among species. Additional analysis will focus on reconstructing population histories of each species, identifying past demographic processes within each species, and where appropriate on refining current species boundaries. Preliminary data suggest that several of the groups we are targeting may in fact contain new species, a finding that could have important implications for conservation planning in Patagonia.

**Broader Impact:** Our project is designed to catalyze a cultural exchange in evolutionary research between U.S. and South American institutions of higher education. Over five years, our project will bring together over 100 scientists and/or students from the United States, Canada, Chile and Argentina, collectively representing eight institutions of higher education. A key objective is to foster long-term partnerships among researchers and students in each of the four countries. We will accomplish this by: (1) grouping scientists and students across international boundaries to solve specific research problems; (2) sponsoring study-abroad internships with non-NSF funds to allow graduate students from each partner country to work in an international setting; (3) conducting collaborative field expeditions in Chile and Argentina; (4) holding annual international meetings to report on research progress; and (5) developing tools for bilingual dissemination of information through web-based applications.