

## PROJECT SUMMARY

Often interpreted as the oldest extant assemblage of land organisms, the hornworts are a crucial group in characterizing early patterns of terrestrial diversification. In spite of a recent renewed interest in land plant evolution and a near “explosion” in phylogenetic investigations of mosses and liverworts, the systematics of hornworts has remained relatively unexplored. **This proposal outlines a detailed collaborative project that will provide a portrait of the phylogeny, biodiversity and biogeography of the hornworts.** Information on genetic and morphological biodiversity will be accumulated for the first time for hornworts collected from multiple geographic regions by an international assemblage of experts on these plants. The program goals are to: **1)** establish a robust worldwide phylogeny of hornworts; **2)** produce a revised classification; and **3)** identify biogeographic patterns of hornwort diversification. This first ever study that focuses on hornworts will greatly expand knowledge of this widespread but relatively obscure group of plants, and will also explore more global issues relating to biological diversification and biocomplexity.

The first goal will be achieved through the analyses of multiple molecular data sets and comprehensive data sets representing morphological, ultrastructural, functional and developmental characters. Gene sequences generated from all three genomes have been selected to provide an appropriate number of informative sites to resolve hornwort phylogeny at all hierarchical levels. Morphological data will encompass features that are emphasized in taxonomic treatments and new ultrastructural data that enable within hornwort comparisons as well as more global comparisons with other green plant groups. The resulting estimate of hornwort relationships will be used to inform decisions on classification. This approach will clarify the present poorly defined familial, generic, and specific boundaries. Comparative morphological investigations will provide critical data in evaluating hypotheses of adaptive evolution within the group and in placing these innovations into the broader context of plant evolution.

When evaluated in conjunction with distribution areas of hornwort species, phylogenetic analyses will enable a first reconstruction of the biogeographic history of the group. Accordingly, global patterns of diversification and specific questions relating to southern hemisphere biogeographic and biodiversity will be tested.

The PIs have demonstrated a strong commitment to providing enriching and supportive educational experiences for undergraduate and graduate students. Both have been involved in a number of university and community initiatives to develop research and professional experiences for elementary, high school and undergraduate students. The PIs stress teamwork and are committed to establishing a supportive mentoring network for all members of their laboratory. Students involved in the project will engage in all aspects of the research enterprise, including professional activities such as presenting at meetings and publishing manuscripts. Rotations between the PIs laboratories will provide exposure to the range of techniques and analytical methods that are available to systematists.

As the director of the Undergraduate Research Program at SIUC and as an active member of the Center for Systematic Biology, K. Renzaglia will provide a broad base of experiences for training students in plant systematics. As a new researcher and faculty member, J. Duff already has gained recognition in the university community for his devotion to quality education. Since 1999, he has attracted seven undergraduates and one graduate student to his laboratory and these students have approached problems relating to the systematics and evolution of a wide range of organisms, including animals, plants and protists. Moreover, the international component of this proposed program will provide the resources and opportunities for students to explore collaboration with students and scientists from a diversity of cultures and backgrounds. By the dissemination of data through the construction of a website dedicated to the project, awareness of hornwort biology will be extended to the global scientific community as well as the general public. Clearly, support of this program on hornwort systematics will have an impact on the infrastructure of education within the PIs institutions, communities and beyond. It is an investment in American education and a positive step toward training a future generation of informed and skilled scientists.