Student Training Plan

Training on this project is focused on closing gaps that have been recognized across the life science spectrum, from undergraduate through post-graduate. The need to fill these gaps is critical [1]. Several of the co-PIs have long been engaged in bringing biodiversity science to the undergraduate level [e.g., 2, 3], and co-PIs Guralnick and Soltis are on the Steering Committee of a new RCN entitled, "Biodiversity Literacy in Undergraduate Education (BLUE)" (A. Monfils, PI). At the graduate level, we focus on workshops and cross-training between labs, stressing the importance of broad training in biodiversity science as an integrative discipline and how new tools are critical for continuing to assemble the most refined view of the tree of life, the data layers that adorn it, and other dimensions of biodiversity. At both the graduate and postdoctoral levels (see also Postdoctoral Mentoring Plan for the latter), our goal is to develop a strong framework for joint participation in annual meetings, where students can take a lead role in presenting their efforts and integrating their work with the efforts of the larger team. We plan to develop workshops that reach the broadest community. The training involvement on this grant extends to those faculty, staff, and interested members of the biodiversity community and beyond who want to learn more, as we describe below. The total package is meant to enhance the ability of all participants to perform fully interdisciplinary and integrative work. We provide more detail on key training initiatives below.

Team Science: Understanding ecological systems at scales critical for human decision making requires interdisciplinary scientific synthesis [4], which is increasingly performed by teams (Wuchty et al. 2007; Smith et al. 2014). Team science has fundamentally changed the process of knowledge creation; teams are more likely than solo authors to produce novel, high-impact research, and their papers are more frequently cited [5]. The interdisciplinary efforts at the core of biodiversity science in general and of this project in particular are critical for scientific discovery. Successful interdisciplinary training therefore requires training in team science as well as in scientific disciplines, and a foundational component of the training program for this project will be integration of team science principles. The "science of team science" indicates that high-performing teams are diverse [6] and multi-institutional [7]. Critical factors for success include development of strong interpersonal skills, a shared vision, strategically identifying team members and building the team, managing disagreements and conflicts, and setting expectations for sharing credit and authorship[4, 6], including adoption of new metrics for individual success. We will emphasize team science principles in our individual training of students and postdocs and through our collective interactions and training as well.

Undergraduate Research Training: Undergraduates will be involved in training workshops in data science (detailed below) and will practice the skills they learn while completing field- and laboratory-based data collection. Undergraduates will be encouraged to pursue independent projects focusing on any number of the aspects of our project, from modeling to data science to empirical ecology and/or evolution. Such projects are supported by funding opportunities for undergraduate research at all participating institutions, and complementary courses, both capstone senior seminars in thesis writing, and analytical training labs.

Graduate and Postdoctoral Research Training: Our main goal of graduate and postdoctoral activities is to enhance needed integrative training in biodiversity science. Training at each institution will vary depending on the number of students/postdocs and the academic level of the trainees. Strong graduate and postdoctoral involvement is planned for monthly cyber meetings and all in person project meetings, including a half-day symposium for students to present their work and

receive feedback from all members of the team at the working group and workshop to be held at the Santa Fe Institute. Graduate students supported on this project will enhance a vital and interactive graduate community and will build connections via graduate training across institutions in the project. Graduate students and postdocs will receive training through their respective labs but will also interact as part of the larger project. We also plan for lab rotations so that students and postdocs working on this project have the opportunity to spend 1-4 week periods at other institutions, learning about efforts and obtaining necessary skills. These cross-training lab rotations will provide the broadest exposure across the collaboration. This active training is supported at all participating graduate institutions by a strong formal curriculum in biodiversity science, with courses in Principles of Systematic Biology, Molecular Systematics, Advanced Phylogenetics, Phylogenomics, and Phylogenetics Seminar.

Career Development: Primary aims of any training experience are to gain new skills and increase scientific independence. Student training will include personalized advice on academic and non-academic career options based on the interests and long-term career goals of the students. We will provide training in developing an independent research program, developing effective collaborations, preparing for job applications and interviews, combining and integrating teaching and research, mentoring students at different career stages, and engaging in broader impact and public outreach activities. We use several resources to guide our mentoring of both students and postdocs. We will work with students on various aspects of an academic career, including manuscript preparation, presentations at conferences, professional networking, and grant writing. The students will be integral to the project and will meet with their mentors at least once per week to discuss progress, problems, and solutions related to both research and career development.

Community Training: We plan on one physical workshop (at UF) and one massively open online course on data skills for biodiversity science to reach broad audiences. Newly renovated space and a commitment to community training make UF an ideal location (co-PI Soltis is Director of this new institute). Given the size of the community to be enabled, we anticipate 30 participants.

Governance of Training Plan: The PIs will collectively assure that the training plan is met. They will review implementation of the above plan as part of monthly teleconferences as well as via annual project meetings.

References

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