Jacob Landis Personal Mentoring Statement

Why do I think mentoring is important? I think mentoring, or more importantly being mentored, is a critical component of a student’s career path, providing both guidance and a window to new areas of interest. One can learn quite a bit about a given topic by reading books and journal articles, but a strong grasp of the fine workings of a discipline, such as my field of flower evolutionary development and plant systematics, comes from hands-on experience, and my mentoring therefore emphasizes diverse research approaches. I know I would not have made it to where I am today without the time and effort of multiple mentors along the way. Some of the most important things I have learned from these mentors are key laboratory techniques, as well as how to be successful at communicating my ideas for grant proposals or publications. I am passionate about plant biology, and I share this enthusiasm through mentoring diverse groups: high school students, high school teachers, undergraduate or graduate students. As described below, my approaches vary depending on the mentees, but my overall goal is to excite them about plants.

I mentor high school students in the hope of inspiring some of them to continue their studies in biological sciences, and more specifically botany, once they reach college. You never know who might make the next big discovery, and if I can help even a handful of students find what they are interested in, I believe I have succeeded. During my first three years in the doctorate program at UF, I have taught multiple lab sections of BSC2011 (Integrated Principles of Biology 2). Each semester, the vast majority of students say that plants are boring and that they cannot wait to finish the plant sections. One specific example from a previous student was “BSC 2011 was not quite as easy for me as BSC 2010: ever since high school biology, concepts concerning plants were quite abstract for me to visualize and fully comprehend.” I think that part of this mindset comes from how biology is typically taught in the high school classroom: students copy notes from a projector and do assigned readings, with little hands-on exposure to organisms (and then generally invertebrates). In my own experience, plants were almost completely ignored, except for some very basic information and their placement in the domain Eukarya. How could plants not be boring, with this sort of treatment? This perceived “boringness” of plants and how they are represented in the classroom is what I am trying to help change, one group at a time.

During the past two summers, I have had the opportunity to work with nine groups of Florida high school students through the Summer Science Quest and STEM immersion programs of UF’s Center for Precollegiate Education and Training (CPET). Over these two years I have worked with 247 students conducting a six-hour plant systematics module, with the help of undergraduate assistants and fellow graduate students in the Biology program and Florida Museum of Natural History. Our goals were to teach students basic molecular techniques, to increase the students’ interest in botany, to emphasize the role of pollinators in our world, and to put botanical research into a broader and accessible perspective. During these modules, I drew from my own research interests in plant evolutionary biology to design experiments and discussions focused on how we determine species relatedness in plant groups, how flower color is an important evolutionary trait in relation to pollinators, and how new plant species may arise. For each module, twelve plants with strikingly different flowers were used to showcase the interaction between plants and their pollinators. Students extracted DNA from leaf material, used PCR (polymerase chain reaction) to amplify common genetic loci used in plant phylogenetic studies, performed gel electrophoresis to visualize PCR results, and constructed phylogenetic trees based on both molecular and morphological data. Students then used their phylogenetic trees to infer patterns of floral change and associated changes in pollinators. After each module, based on assessments, students reported both a better understanding of evolution and an appreciation for botanical research that does not portray plants as boring. From the first summer’s iteration of this program, Julie Bokor, the Assistant Director of CPET, and I have a manuscript in press in CBE Life Sciences Education detailing our findings of students’ understanding of tree thinking, which should aid K-12 educators in their pursuit of teaching evolution.

In addition to my direct mentoring of high school students, this past summer I worked with 10 high school teachers through CPET’s Summer Science Institute. I shared the above-mentioned phylogenetic module with the teachers and then discussed areas of improvement with them. With the help and insight of the teachers, we designed new ways to make the material more accessible for students, as
well as alterations to adjust the challenging aspect of the module for different levels of students. The goal is for the teachers to incorporate these activities into their lesson plans when covering botany topics. Two of these teachers are co-authors on a presentation that Julie and I will give at the National Association for Biology Teachers conference in November, to share the module with a wider audience of educators.

The group of students I spend the most time mentoring are undergraduate students interested in research. Through this mentoring, I help students identify what options are available to them after their bachelor’s degree and teach them skills to help them attain their goals. When I began doing research, I had no clue what I was doing or what I wanted to do, as I suspect is typical for students at this level. With the help of many mentors, specifically two post-docs (one during my undergraduate research experience and the other during my Master’s program), I learned the techniques, skills, and mindset needed to succeed as a graduate student and in academia in general. I try to pass on what I have learned to make other students’ experiences better.

Each student whom I mentor in the research lab is unique, with no two students ever taking the exact same route. When a student first starts working with me, I always use a quote from the 1999 film Fight Club. I tell the student that, “they determine their own role in project mayhem,” or in this case they determine their own level of involvement in the lab and research. Specifically, I leave it up to the student to decide if he/she wants to do small parts of projects that I assign them, or if they want to move past that and have their own project, or somewhere in between. Since I started my doctorate program in August 2011, I have mentored seven undergraduate students. Most of these students work in the lab for multiple semesters, with three of my current students having been in the lab with me for over a year and a half. One of my students has a prestigious Beckman Scholars fellowship working on a project involving flower color evolution, and another student received an HHMI Science for Life fellowship studying the evolution of flower length. Both of these fellowships were very competitive, with each student writing a research proposal for her intended project. In addition, both students also were selected for the University Scholars Program but declined them because of greater funding and opportunities through Beckman and HHMI.

For all of my students, their first several months in the lab involve working side-by-side with me to ensure they learn the techniques correctly and have every opportunity to ask questions. When they feel confident about what they are doing, we develop their abilities to work independently by having them complete tasks on their own time schedule, meeting once or twice a week to discuss their work. Eventually the relationship evolves from complete dependence on me for every step in the process to more of a collaborative effort. In this case I am still available if needed, but I push them to think critically to solve problems that arise. Some of the lab techniques I help students learn are DNA/RNA extractions, PCR and gel running, seed germination methods, scoring live and pressed plants for floral traits such as color and size, and how to use phylogenies for studies of flower character evolution. However, the skills that I find most important go way beyond laboratory techniques and include preparation of grant proposals, submission of abstracts for conference presentations, and preparation of scientific posters. Two of the undergraduates I mentor have been successful with grant applications, with each having received research funding from the Botanical Society of America. One of my students, Maggie Hernandez, has presented her research at multiple venues, including the annual Evolution meetings (Raleigh, NC), the annual Botany meetings (Boise, ID), the annual Beckman Scholars national meeting (Irvine, CA), and multiple events at UF.

I also mentor fellow graduate students. This semester I am teaching the BSC2011 labs for the third time and am therefore one of the more experienced teaching assistants. At the beginning of each week, we have a TA meeting to discuss the upcoming week, and I provide the new TAs hints on what works for that lab, and what they may have issues with. Many of the new TAs (some weeks as many as 6) sit in on my lab sections to get a better grasp of the lab that week. I always have an open-door policy for anyone who would like to attend my labs in hopes that it will make them feel more comfortable with the material. The result is a positive impact for the undergraduates whose TAs have gained additional help.

The broader impacts of my mentoring are two-fold: increasing students’ interest in biology, especially botany, for those trying to select a career path, and personally providing those interested in pursuing graduate degrees with the opportunities and skills to be successful.