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A CURE FOR PLANT BLINDNESS?
Teaching techniques to connect biology undergrads with plants

By Javier Francisco-Ortega, Ph.D.; Nichole Tiernan; Jonathan Flickinger; Wendy Villavicencio; John Geiger, Ph.D.; Brett Jestrow, Ph.D.; Chad Husby, Ph.D.; Roberto Pereira; Janelle Núñez; Jose Alberto; Jessica Colón; Hong Liu, Ph.D.; and Melissa McCartney, Ph.D.
During the last 80 years, teams of professional botanists and horticulturists have gathered for the Garden one of the world’s best collections of tropical plants, ensuring that the Garden is a celebration of the beauty and adaptations of plants throughout the tropics. These collections have also given professional educators an extraordinary opportunity to increase plant awareness among students, mostly from within our community.

Fairchild’s educators are engaged with students from elementary to college levels.

Starting in summer 2016, a group of Florida International University (FIU) faculty members and Garden botanists joined forces to implement an educational initiative that targeted freshmen enrolled in FIU’s General Biology courses. They come to the Garden once during the semester for a three-hour experience exploring Fairchild. During their visit, they are exposed to our living collections, research laboratories, and conservation programs. So far, during 9 consecutive semesters, a total of 1,500 students have been engaged through this venture. One important goal of this project is to alleviate plant blindness: the tendency of humans to recognize, memorize, and distinguish animals’ attributes much better than those of plants.

This under-appreciation of plants is particularly relevant today, as plant awareness among the public is important in order to design and implement comprehensive conservation policies. Most students in college biology programs in the U.S. want to develop careers in health-related disciplines. Therefore, they often feel botany subjects are irrelevant and even a burden for their professional paths. Our educational initiative specifically targets these particular students, as we believe that medical professionals have the potential to become the best ambassadors for plants because of the broad community that they reach through their work.

MAKING THE MOST OF GARDEN TIME

At its foundation, this program is aimed at bridging the content and scope of the Garden’s living collections with the material covered during the students’ biology lectures and laboratories. We explored Fairchild extensively as we prepared the curriculum for the visits, and we drew on our own experience as FIU educators. For the last 20 years, FIU educators have used the plants in the FIU Nature Preserve and across the main campus to teach portions of the General Biology laboratory courses.

Our experience has led us to believe that there are three key strategies that will help these students to understand, value, and appreciate plants during a short Garden visit:

1. **Cover a limited scope of plant examples.** Based on our experience, students disconnect from plants the moment they are bombarded with scientific jargon or with many cases of plant adaptations and features. In our educational tours, we cover...
only three case studies per hour and they all relate to topics taught in class. The time that students have to “ramble” through the Garden during their visits is also highly valuable and relevant to our goal of alleviating plant blindness. Therefore, we do not rush as we walk between each of the case-study plants.

2. Follow a critical-thinking approach. As the tours are delivered, we allow students to discover by themselves how each case study’s concept layers relate to topics covered in class. Our critical-thinking approach follows a Socratic method based on asking and answering questions in order to stimulate ideas and arguments that help the students understand and value particular plant traits.

3. Focus the learning content on exceptions to biological rules. We are convinced that students can really understand how biological processes operate through cases that highlight exceptions displayed by plants. Exceptions trigger students’ curiosity and lead to discussions on why a particular trait of a plant does not follow the biological rules taught during the lectures.

We share these three strategies with the students before their educational tours began. We have found that understanding this approach at the very beginning of their visit lets students know that their minds will be challenged through their own discoveries. All pedagogical studies show that the component that students value the most from learning is having their intellect challenged. We took this to heart.

One important lesson from previous pilot educational visits is that students will only truly participate in this kind of initiative if they receive academic recognition for doing so. Because this activity takes place outside the FIU campus, student participation is voluntary, and without rewards, attendance is poor and students are not terribly engaged with the tour content. We have set up a reward system that allows students who participate in the Garden visit to earn a certain number of extra credit points towards one of the laboratory course quizzes. At the end of each tour, students have taken individual tests to evaluate the concepts they learned during the visit, earning extra credit points based on their answers. These tests also have questions related to students’ perceptions of botany, and we also asked those questions of students who did not attend the tours. These tests have been critical in evaluating the impact of these visits on student plant blindness.

WHAT WE STUDY

The student visits cover three Caribbean palm species, one cycad species, the cannonball tree, the ceiba tree, orchids, and the Wings of the Tropics butterfly exhibit in The Clinton Family Conservatory. Our discussions include biological exceptions such as: Why do plants have amino acids that are not made to build up proteins? Or, why do some plants exhibit branches that look like roots and therefore do not grow up but down?
In order to broaden students’ perceptions of plants and their relevance to humans, we discuss the importance of plants in the history of religions and the way most civilizations have used them as connection elements with their deities or supreme beings. We emphasize that plants are much more than sources of food and oxygen for humans, and within this context we use Fairchild as an example of how gardening and landscaping can lead to artistic creativity and beauty. Finally, we highlight plants as systems in order to understand the basis of biological processes related to organisms’ adaptations to different environments. For example, while examining the cannonball tree, students discussed hypotheses about mechanisms to regulate cell division during development of pollen, hormone activation of reproductive tissues, and allocation of resources to produce energy-rich sugar compounds in different parts of the plant.

DID THESE VISITS ALLEVIATE PLANT BLINDNESS?

Our team is currently analyzing the data from these visits, but our preliminary and initial results suggest that students who joined the Garden tours developed a much more positive perception of plants than those who were only exposed to the botany content covered in the lab or classroom components of this course.

We are working with a National Science Foundation (NSF) Incubator Grant, funded from the Research Coordination Networks in Undergraduate Biology Education (RCN-UBE) program. Through this NSF-supported project, in early 2020 the Garden will host a workshop involving prominent botanists and educators from several prestigious universities and botanic gardens. This brainstorming event aims to further develop educational activities to alleviate plant blindness among undergraduate students in other higher education institutions.

AUTHORS
All of the contributors have been actively engaged either in design of the educational curriculum, the student mentoring strategy, or evaluation of the outcomes of this educational project. The NSF grant process was led by Dr. Melissa McCartney, assistant professor in FIU’s Department of Biological Sciences and STEM Transformation Institute (principal investigator); Dr. Hong Liu, FIU and Fairchild Tropical Botanic Garden research ecologist (co-principal investigator); and Dr. Javier Francisco-Ortega, FIU-Fairchild professor in the Department of Biological Sciences and International Center for Tropical Botany (co-principal investigator).

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