

Committee on Education Policy
Preliminary Findings and Recommendations
Plant Biology Undergraduate Program Review

Background

The Plant Biology major at UCR is an interdepartmental program that primarily operates under the auspices of UCR's Botany and Plant Sciences (BPSC) department, which provides both administrative support and houses most of the faculty who participate in the program. The Undergraduate Educational Advisory Committee (UEAC) oversees the Plant Biology undergraduate program, organizes recruitment activities, and drafts program changes, which are voted on by the entire full time BPSC faculty of 33. The UEAC Co-chairs also serve as Co-undergraduate advisors. The program is also supported by 8 Cooperative Extension (CE) Specialists and several Cooperating Faculty Members (CFMs), who contribute to undergraduate research activities.

The mission of the interdepartmental undergraduate program in Plant Biology is to provide students with a solid background in modern principles and research practices of basic and applied Plant Biology as well as focus in an area of specialization: Plant, Cellular, Molecular, & Developmental Biology; Plant Genetics, Breeding and Biotechnology; Ecology, Evolution, & Systematics; Plant Pathology, Nematology & Pest Management; or Individual Specialization.

Plant Biology majors may earn a BS or a BA. All majors must complete the Life Sciences core requirements (calculus, biology, general and organic chemistry, physics, statistics, and biochemistry) and 23 units of common upper division coursework in plant biology subdisciplines and genetics. Students who opt for the Plant Biology BS also take two units of research course work and eleven units of upper division coursework in one of five areas of specialization identified above. Those who choose the BA take eight upper division units in one of these five areas of specialization *and* foreign language coursework. The Plant Biology BS has averaged 45 majors over the five-year period 2015-2019, during which two students--a Cell, Molecular, & Developmental Biology major and an Environmental Sciences major--minored in Plant Biology.

The racial/ethnic and gender diversity of Plant Biology majors reflect the diversity of UCR's undergraduate student body as a whole--predominantly Hispanic (42 percent) and Asian (34 percent), with 11 percent, 6 percent, and 3 percent of students identifying as

white, Native Hawaiian or Pacific Islander, or Black or African American, respectively. In the most recent year for which data were provided (2019), 43 percent of Plant Biology majors identified as Hispanic, 29 percent as Asian, 10 percent as white, and 5 percent as Black or African American. Similarly, most Plant Biology majors were female (54 percent), reflecting UCR's majority female (56 percent) undergraduate student population.

The CEP review of the interdepartmental undergraduate program in Plant Biology was conducted from April 19-22. The External Review Team consisted of professors Daniel Kliebenstein (UC Davis), Elizabeth Toby Kellogg (Danforth Plant Science Center), and Ramin Yadegari (University of Arizona). The External Review Team's report was submitted on May 28, 2021, and administrators of the Plant Biology major responded to any factual errors on June 12, 2021. CEP provides a neutral summary of the report that is not intended to emphasize or deemphasize (e.g., through omission) any of the review team's findings. CEP's recommendations are provided at the end of this document.

External Review Team Report Summary

The review team was impressed by the Plant Biology undergraduate program, judging it to be an excellent program that offers the full breadth of topics that should be covered in a major program plus the requirement and wide availability of undergraduate research opportunities. The review took particular note of the outstanding advising provided to majors, including critical help getting majors started on research. Key points made by the review team include:

- Student satisfaction with the major is generally high, especially in regards to individualized advising, small classes, and diverse research opportunities. Majors include a high number of students from under-represented STEM communities. Of particular note is the availability of faculty undergraduate advisors who are key to helping students identify research opportunities early in their studies. The combination of a two-credit research requirement along with plentiful research opportunities is a strong point of the major. The review team concluded that graduating students are well-prepared for starting their careers and have many options open to them, including graduate study. The integrative nature of the program along with its academic rigor are responsible for the many options students have.

- The review team recommends a number of improvements that can be made at the department level.
 - The program's student community should be enhanced by increasing the number and variety of social events that bring students together, by encouraging majors to participate in existing and perhaps newly-formed clubs, by increasing the major's presence on social media, by getting students involved in research earlier than their junior year, and by encouraging students to take advantage of major-related volunteer activities.
 - Increase visibility of career paths not involving graduate school by providing more information events and better utilizing the UCR's Career Center. The information events could serve a dual purpose as one of an increased number of networking/social event. Also, increasing faculty advisors awareness of non-grad school career paths would be helpful given the one-on-one advising relationship the program offers.
 - Increasing the already-strong connection with local community colleges would enable the program to attract a greater number of students from underrepresented STEM communities. The program already has a greater proportion of such students than other majors in CNAS. The review team recommends building on this success.

- The review team also made recommendations about what the campus can do to strengthen the program.
 - Limited lab space for the gateway course BPSC104 prevents expansion of the major. The physical limit on lab space for the course combined with its popularity as a means for meeting non-major lab requirements means that Plant Biology majors often cannot take the course until they receive enrollment priority as seniors. Allowing students to take the lab early in their junior year would facilitate students "trying out" the major while they still have time to switch.
 - Increase the visibility of majors in CNAS that are not Biology. Greater information provided to first-year students about career paths and learning opportunities in Plant Biology and other under-utilized majors would serve both students and faculty within the college. Students would benefit by making a major choice different from Biology that is too-often the default choice of students. Increased flexibility in the biology core requirements

would allow students to take a greater diversity of courses before they are locked into a major in the junior year.

Program Response to External Review Team Report Summary

The Plant Biology's response to the report included two minor points, communicated to CEP by the Chair of Botany and Plant Sciences (Prof. Patty Springer):

- On Pg 2, the report states "The successful Dynamic Genome course initiated and taught by Sue Wessler is a major early gateway for research engagement." It is true that Dr. Wessler developed this course and teaches it, but we note that a number of other faculty, many in BPSC, also teach this course, as it has 8 offerings per quarter.
- Pg 5: "In discussions with the Department, it was noted that they could relatively easily make this experience available to two to three times the number of current students and thus increase the size of the major." I note that while we believe this to be the case, we have not yet attempted to do a thorough analysis of our capacity.

CEP's Findings and Recommendations

On the basis of the review team's report and the Program response to the summary, CEP recommends the following:

1. The Plant Biology major should assess its capacity for growth in enrollment and identify limitations. This assessment should include: Identifying faculty who can take on undergraduates for research projects, or who could create upper-division laboratory courses that create such opportunities; enrollment capacity and number of offerings of courses that count for credit towards the major; and programmatic bottlenecks (such as BPSC 104); re-evaluate the core requirements of the major, and consider reducing requirements in Chemistry and Physics.
2. Pursue mechanisms to increase the number of offerings of BPSC 104, which is currently a limitation for students, impacted by high enrollments from other life sciences majors and limited availability of space. This will require getting support from outside the Department.

3. Find ways to advertise the major as an alternative to Biology, particularly as they are finishing the core sequence of courses in their sophomore year. For example, BPSC faculty who teach in core courses (e.g. BIOL 5C, BIOL 102) could advertise the major to the students.
4. The Plant Biology Undergraduate Major website should be enhanced, by providing such information as: how to pursue specific research opportunities; testimonials from former students; what alumni of the program are currently doing; describing advantages of the program compared to other majors; volunteer and internship opportunities; career options for students who complete the major; information for transfer students; pictures of students in various settings.
5. The major should improve dissemination of information about career development, through a combination of: posting information on its website as indicated above in (4) working with the Career Center; training faculty who have students doing research to mentor them about career prospects; and offering workshops for students to explore career possibilities.
6. The program should look for creative ways to engage their majors in settings that allow them to interact with faculty and each other, such as organizing additional social events and seminars/webinars. The program should consider creating a social media presence (e.g. Instagram or Twitter) for students to subscribe to, which could be used to disseminate such information as well as publicize achievements of research faculty and students in the Department. Additionally, any faculty who maintain an active social media presence could be encouraged to make that information available on syllabi and/or on the program website.
7. The Course Catalog for Plant Biology should be streamlined to include only courses that are still offered, or indicate how often courses are available.
8. Identify ways of rebranding the department research in a way that will help make the case for future hires to help cover both teaching and research needs in emerging areas in Plant Biology, such as machine learning, artificial intelligence, high throughput phenotyping, predictive genomics, computer vision, etc. as suggested by the reviewers.