EXTERNAL REVIEW
Biology Graduate Program
Sonoma State University

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Summary

The Department of Biology Graduate Program is one of a select few graduate programs at Sonoma State University, where there are twelve programs on State funding and five programs on self-support, out of thirty-six academic departments. Over the roughly five years since the last formal Program Review, the program boasts about fifty students who have completed their work, forty-six of whom (92%) are currently employed or studying in a field relevant to their graduate degree, a stellar success for any program. In the most recent year, despite the ravages of a pandemic and college enrollments that are declining for a number of reasons, the program had about fifty applicants for sixteen admitted. The apparent enthusiasm and dedication of the faculty makes even a seasoned professor want to enroll as a graduate student.

This report is based on the internal program review dated Spring 2021, and a virtual visit with faculty, staff, students and administration, including a virtual tour of facilities, on 18-19 March 2021.

Response to Specific Review Objectives

Curriculum coherency and currency.

The graduate program is a standard thesis program with a written thesis and thesis proposal requirement, an oral Qualifying Exam on one's thesis proposal and on general knowledge in the discipline, and an oral thesis defense. The program has a very clear Mission and Goals statement on page 2 of the internal review report:

> To provide a premier, nationally recognized Master's level program in the biological sciences that allows students to: 1) develop a skill set that includes critical reasoning, creativity, self-expression, and the ability to collect, synthesize, and analyze information from a variety of sources, 2) generate new knowledge about the biological world by making observations, forming hypotheses, developing and evaluating experimental designs, and gathering and analyzing

data, and 3) prepare for a career or career shift either by pursuing a Ph.D. or by obtaining a job that uses their biological knowledge and skills.

The curriculum is fully aligned with these objectives and with the Program Learning Objectives (considered further below).

Faculty are actively engaged in contemporary research in biology, with the newest faculty hires representing rapidly-advancing fields, ensuring that the curriculum remains current and adaptable.

Relevance and clarity of learning outcomes and integration with curriculum.

The broad background in biology is obtained in the undergraduate program; half of the students obtained their undergraduate degrees in biology at Sonoma State, while most of the remainder obtained similar degrees elsewhere. Deficiencies in background can be identified by the advisor or graduate coordinator and remedied as needed.

More specific, graduate-level factual knowledge, as well as skill in critical reading, thinking and data interpretation are attained in several seminar courses that run under different titles as BIOL 500S. Table 1 on page 5 of the internal review lists the titles over the last five years, ranging from "Scientific and Professional Skills" to "Manipulating Genomes" and "Macroevolution." Students can put together a very exciting course experience with the several choices offered over the course of two years. A minimum of three BIOL 500S topics are required for the degree.

It is possible that some of the BIOL 500S topics could be developed into full 3-unit rather than 1- to 2-unit courses, although the BIOL 500S course mechanism is very appealing.

Most students will take half of their units from thesis-related research and preparation. Other courses, such as TA instructional skills and a colloquium (which brings in outside scientists as speakers), and up to 15 units of undergraduate upper-division courses, can also be taken.

Table 1 also identified which of the PLO's are met in each course offered, with the core of thesis-related courses (BIOL 597 and 599) and one option in BIOL 500S (the skills-related sections) meeting *all* of these objectives.

The curriculum allows students considerable flexibility in scheduling and course selection to meet their individual needs.

Meaningfulness and effectiveness of learning outcomes assessment and use of assessment for program improvement.

Ongoing assessment is one of the greatest challenges in higher education. But the bottom line for graduate programs is suggested in goal 3 on page 2 of the internal report, "… prepare [students] for a career or career shift either by pursuing a Ph.D. or by obtaining a job that uses their biological knowledge and skills." The faculty documented that 46 out of 50 students met this goal, a stunning achievement in broad program like this. Page 26 of the internal review identifies "Student Career Tracking" as one measure of assessment in use. Continued contact with alumni is also important to encourage programs that have admitted Sonoma State students, or companies that have hired them, to return looking for more.

Student progress is also assessed through written materials and oral exams. This includes at least four points of intervention. Students who don't succeed at any of these points are ordinarily asked to do further work to make up the deficiency, which is a constructive response the outcome of these assessments.

In addition to assessing student outcomes, the Department is assessing its own actions in responding to previous program reviews. Five short-term changes were suggested, and most of these appear to have been implemented successfully. One of the issues concerned timely completion of oral examinations, which should be monitored on a continuing basis. However, it appears that the graduate coordinator checks in regularly with students as one effective means for ensuring that students meet benchmarks on time. In another area, there is no clear indication of a meeting with development and advancement staff about direct philanthropic support for the graduate program. The importance of this is addressed elsewhere in this report.

Sufficiency of resources and how they affect the quality of the learning experience; consider, for example, faculty, facilities, support, information resources, and research resources.

Based on the number of applicants to the program, there is room to grow and maintain a high diversity and quality of students. Limiting factors, as in many institutions, are faculty positions, operating funds, and research laboratory space. All of these are acknowledged at least at the Dean's level, and it appears that the Dean and Interim Provost are interested in making inroads into these issues. With Sonoma State suffering from reduced enrollment and a budget shortfall, the ideal solutions of additional faculty slots, building out spaces, and increased operating funds are unlikely to become available in the next two years.

Dean Wade suggested that there are some underutilized spaces that could be reallocated, and this would be a sensible way to begin dealing with space issues. Even with faculty hiring only at a replacement level, this would be needed to allow incoming faculty to undertake the higher levels of research, grant funding and student involvement they plan.

One way to expand student opportunity is to explore interdisciplinary work in which the student is able to perform research in laboratories in other departments. Without

graduate programs in many other departments, this presents some difficulty, but a present collaboration with Anthropology, in which a faculty member supervises Biology graduate students, is a model situation. Moreover, Biology has historically worked with other departments in a similar way. There is a growing understanding that the future of science is interdisciplinary or multidisciplinary rather than confined to the traditional department structure, and these additional disciplines are not just in the science, but in areas like art, journalism, social sciences, history, policy, and philosophy. This would leverage the broad liberal arts reputation of Sonoma State. The work could be largely done in and managed in another department, but the ideal would be to make it interdisciplinary, with extensive involvement from thesis committee members in Biology.

Although the University is not in a major metropolitan area, there are opportunities to interact with nearby institutions or companies, including the Buck Institute for Research on Aging, Dominican University, and BioMarin, not to mention the wine industry. Other CSU's and UC's are within a reasonable distance, including Sacramento State, UC Davis, San Francisco State, UC Berkeley, and San Jose State University. In a similar model, San Francisco State has active collaborations involving students with UC San Francisco, the Buck Institute, BioMarin, Genentech, and Stanford University. Rather than competing with each other in these collaborative relationships, the CSU's are leveraging each other's reputation as a source of superb students from diverse backgrounds.

The previous External Review mentioned the issue of donor-based funding. Only minimal progress appears to have been made in this area. The $20,000 operating budget for the Department is painfully inadequate, not even allowing for the *maintenance* of the most critical teaching and research equipment. Like most other CSU campuses, Sonoma State has generally under-appreciated the value of its donor base, including alumni, local supporters, and businesses. Maintaining, let alone expanding, the graduate program "takes a village," and University Advancement needs to be a key player in this development effort. If there is not a development director assigned to the College or Department, the faculty should approach the Vice President for University Advancement to make such an assignment, and that individual should be invited to present and discuss options with faculty and staff in departmental meetings. But the Biology community on campus will also need to be a part of the effort. Students have to tell about their experiences, faculty need to talk about their research, and staff members need to join them in presentations and events showcasing their work, and perhaps in providing reports or newsletters that are pushed to alumni. (The web site is excellent, but it is a passive means of communication.) A target of $50,000/year to support faculty and student research seems reasonable, and could make a big difference to the graduate program.

Return on indirect cost (IDC) can be a significant benefit to faculty and student research. Sonoma State has a reasonable indirect cost rate of 51% on major Federal research grants. 20% of IDC is returned to the College, of which 16% is subsequently returned to the Department and the individual grant Principal Investigators (PI's). A reasonable return to the College of 25 to 30% could result in a significant increase in

operating budgets, and should be considered. Return at SF State is currently 25% to the College.

Student support is considered in the next section.

Understanding of students' needs, challenges, and characteristics and ability to effectively serve the program's students.

About half the students in the graduate program are graduates from the Department, with needs and challenges well known to faculty members, and apparently handled very effectively. This ensures that those students have an adequate general background in biology and related fields, and that they have met requirements in writing and critical thinking already. The remaining students come from a variety of institutions, including other California State University campuses, and would be expected to have a more varied background. Non-CSU sources include UC Santa Cruz, Santa Barbara, San Diego, Berkeley, University of Washington, University of Hawaii, Minnesota, Oregon, Nevada, Colorado and Massachusetts. There are, at present, no international students, which is not surprising in view of the political situation and travel restrictions related to the pandemic. It appears that the Graduate Coordinator makes a significant effort to get to know each student individually, checking in with some regularity to make sure student needs are being met. In addition, primary research advisors (also called mentors or principal investigators) all appear to have a close relationship with the graduate students under their supervision.

The biggest challenges students might face concerns financial solvency in the face of high tuition and fees as well as living expenses. Sonoma State University has been progressive in providing tuition "waivers" for a limited number of graduate teaching assistants, and the Biology graduate program has taken advantage of this opportunity to help its students. While this somewhat alleviates student financial challenges, teaching does take time out of student's day. However, teaching is a standard part of many graduate programs in science, including those at the Ph.D. level, and provides a chance for students who want to go on to teaching or research/teaching positions a chance to obtain valuable experience. Moreover, the best way to learn a difficult topic is to teach it. The Department provides a course, Biol 501 TA Instructional Skills, in the fall of each year to orient students in pedagogical methods and the kinds of challenges they might encounter in the classroom; this course can count toward the 30 units required in the program and is therefore not an additional burden on students. At present, twenty-two out of thirty students could be supported with teaching assistantships during the spring 2021 semester, and only sixteen of those will have the benefit of a tuition waiver. Expanding these opportunities (assistantships *and* waivers) would have a positive impact on student success. The program has a policy that equitably distributes the waivers among faculty research laboratories, ensuring that each active lab has at least one tuition waiver for a student. Funded laboratories can budget funds for students, and some clearly do, but this level of external funding can be difficult to obtain on a consistent basis.

As part of its student orientation, the program has also had a member of the Psychology Department provide a two-hour workshop on unintentional bias and sexual harassment in STEM. Students may experience harassment, bias or bullying, even from other students, during their training, and it is important to give this level of training, with some follow-up as well as very clear reporting lines and opportunities should the need arise. Information seems to be readily available on the University web site.

Assistant Professor Lisa Hua described her approach to working with students and addressing their particular needs. She encountered different research supervisors in her career, and she adopted the best practices she learned from them. She took a position at Sonoma because she wanted to be able to mentor students, working with them directly in the lab, undoubtedly somewhat of a challenge given current pandemic restriction. She likes to be "engaged just so no one falls between the cracks." This approach seems consistent in the newest as well as the most established members of the faculty.

Additional Observations

Exit surveys.

The program indicated a limited response to exit surveys for graduate students. Anonymity is difficult to ensure with a small number of students graduating each year, but an improved response rate might be achieved by requiring response to a survey when submitting final paperwork for completion. The Department's most recent practice, which is to follow up with surveys one to several years after completion, is an excellent supplementary practice. It is important to track and keep in touch with alumni for further improvement of the program, and for potential donor funding. Central University alumni databases should be made available to the Department as needed.

Pandemic response.

Sonoma State has responded to the COVID-19 pandemic much like other CSU campuses. At the time of the External Review visit, graduate students who needed access to laboratory and field sites were able to work on at least a limited basis.

University Infrastructure Issues.

With few state-supported graduate programs, it is not surprising that the campus-wide infrastructure for the administration of graduate programs is limited. But this means that many of the functions that would usually be done at the Graduate School level must be done instead at the departmental level. This would include marketing, fellowships, admissions and records maintenance, and should be funded appropriately at the department level. While this review does not allow a detailed recommendation, the distribution of functions between the department and the graduate school should be studied in detail.

Another crucial part of infrastructure for graduate programs involves the Office of Research and Sponsored Programs, which should be heavily involved in all faculty and student research, and with research fellowships. This includes identifying novel sources of funding, assisting with all aspect of grants preparation, and providing full administrative support for grant recipients. While faculty members in Biology were surprisingly well-funded and successful, most felt that there was insufficient support in obtaining grants at the institutional level, and that there were issues in grants administration. One individual summed up the situation as "… it… limps along. Better post-award, but no help in pre-award." The faculty should meet with the Associate Vice President responsible for Research and Sponsored Programs to discuss any issues, and the Associate Vice President should be a regular participant in graduate program review interviews.

Staffing.

Staff members within the Department seemed to have a very positive attitude and experience, although they did observe generally increasing workload with unchanging or decreasing staffing levels across campus. Locally, larger laboratory sections have not been accompanied by an increase in technical staffing, student assistance, or space. They were concerned about space limitations, and mentioned long-standing issues with building services like HVAC. Staff have a clear reporting structure to a manager at the college level, of whom they spoke very highly, and a dotted reporting like to and frequent contact with the chair of the Department. They felt treated like colleagues rather than subordinates.

General environment.

Despite the nature of Sonoma State University as a largely-undergraduate institution, with only a few stateside graduate programs, support for research from the administration seems to be very good. The current Dean and Interim Provost appear to understand the issues, as reflected in conversations with Dean Wade, and with faculty discussion of the work of the Dean and Provost. Dean Wade said that she would "like to get more faculty engaged in the graduate program," and acknowledged some intractable space issues campus wide. She expects the University's deficit to go from about $12M to about $3M with the Federal stimulus packages. In view of this situation, she saw no risks to the graduate program, but she did say that it would be hard to grow it in terms of additional faculty positions. The relative isolation of graduate programs and the lack of research-active faculty colleagues in other departments, especially within the college, may remain a headwind unless there are intentional efforts to highlight graduate programs and research. Support for research is also bolstered by an Office of Research and Sponsored Programs. Faculty members spoke very highly of the staff members with whom they worked, but did not feel that the pre-award services and aggressive efforts to attract funds for research were receiving adequate attention. The research office seems to be understaffed.

Graduate Students and Graduate Faculty.

Discussions with faculty and students suggested a very strong, infectious enthusiasm for the graduate program. Students said that they received excellent support from their faculty mentors, and many of the students had also experienced this at Sonoma State as undergraduate students. They found a "support community here… [and were] not lost in the shuffle." Student interaction seems robust. They have a graduate club meeting every other week, stay in touch even now on a SLACK channel, and maintain their own social media page. One faculty member said that "While we'd like more of everything… the quality of the students is high… [and they have a] desire to improve the world." And of the faculty, "Every hire brings more commitment to the graduate program."

Summary Recommendations

Enforce exit survey completion for students, while continuing follow-up surveys, e.g., one, five, and ten years after completion.

Increase fraction of students who can obtain assistantships and tuition waivers.

Increase number of enrolled graduate students when possible, based on increasing availability of funding, on-campus, and off-campus research opportunities.

Take advantage of interdisciplinary, outside advisors for student research.

Explore funding sources like California Institute for Regenerative Medicine (CIRM) training grants, with the possibility of placing some students in off-campus stem-cell research laboratories.

Include "bullying" in anti-harassment training.

Take advantage of a recovering market in international students.

Study department space utilization, ensuring that a policy is in place to optimize use of existing space and, if necessary, justifying a request for additional space, expanding into other areas of Darwin Hall.

Continue to maintain and extend contact with alumni throughout their careers.

The faculty should meet with the Associate Vice President responsible for Research and Sponsored Programs to discuss issues like pre-award service, levels of staffing, and efforts to attract new funding. The Associate Vice President should be a regular participant in graduate program review interviews.

The faculty should meet with the Associate Vice President for Facilities Management and ensure that high-priority issues related to building infrastructure, such as HVAC, are dealt with in a timely manner.

Faculty should meet regularly with the Vice President for Advancement and team members to discuss potential fundraising to support graduate programs and research,

and to discuss how student success in research might be used to enhance the University's visibility in the community.

Consider providing a larger common meeting and study space for graduate students rather than having laboratory and desk space in the same room. The latter practice is becoming less acceptable in view of laboratory safety requirements. There is a space currently, but it is the size of a single faculty office to accommodate more than thirty graduate students.