The Masters of Science (MS) program in Biology at Sonoma State University (SSU) is designed to provide students strong foundations in scientific methodology, scientific literature and technological principles, and to prepare them to enter a variety of professional fields and doctoral programs. The program is thesis-based and requires students to conduct original research under supervision of members of the biology graduate faculty. The program offers a diverse range of research opportunities in the four major areas of biology: molecular and cell biology, physiology and functional morphology, ecology and evolutionary biology, and organismal biology. Along with thesis research, all students complete a minimum of 30 units of course work approved by the student’s advisory committee.

Number of students currently enrolled: 27; Number of theses completed since 1966: 147
Number of full-time permanent faculty: 11; Number of participating faculty from other departments (Anthropology, Chemistry, Environmental Studies and Planning): 4
Number of biology graduate courses: 14; Number of degrees: 1 (Masters of Science)

Upon entering the program, the applicant, in consultation with the major advisor, chooses two additional faculty members to serve on the Advisory Committee. The functions of the Advisory Committee are to (1) help the student plan their course work, (2) serve on the student’s Oral Qualifying Examination Committee, (3) advise on thesis research, and (4) serve as the Thesis committee.

Learning Objectives
The learning objectives for the master’s program are integrated with those for the undergraduate majors, but include additional elements. All upper division major’s and graduate courses (numbered 500 and above) are designed to offer topics within a research-based approach and are structured to challenge students to develop skills of critical analysis, reasoning, creativity, and self-expression. Often, graduate students take a number of upper division classes in the major (up to 14 units of upper division coursework can be applied to degree) and seniors in the major often take graduate classes. This integrates the learning objectives from the major with the Graduate Program. Additional graduate program learning objectives include mastering self-directed learning and demonstrating the ability to conduct independent research.

Assessment
Our program has initiated a data collection effort to evaluate the professional advancement of recent graduates. Data on 38 of 39 graduates are available since 2000. Ten have moved into Ph.D. programs and 4 hold post-doctoral positions in biology at research universities, 11 have taken positions with private agencies, 6 with public agencies, and 7 are involved in education. Since our program is research-based, and peer-reviewed publication is important for the professional advancement of students in many advanced biological positions, we consider the ability of students to publish their thesis work in peer-reviewed journals an important metric of our program’s success and its quality. Since 2002 SSU graduate students have published 19 first authored and 10 co-authored publications in 22 different peer-reviewed journals. While the lag time for publication prohibits direct comparison to completion rates, these data suggest that publication of student theses work has become the norm for the department.

Department Self Study Questions and Action Items.
1. Address concerns about resources to support the graduate program, including:
   a. Lack of sufficient faculty to cover key research areas within cell and molecular biology and support recruitment and mentoring of graduate students with interests in this area.
   b. Lack of WTU resources to deliver the graduate curriculum and needed new graduate courses.
i. WTUs assigned for graduate supervision do not reflect actual workload involved (e.g., same WTUs for one or three units of supervision coursework)

ii. Committee members spend much time in advisory role and meeting with graduate students with no compensation of WTUs

iii. Small class enrollments limits viability of offering graduate level courses other than seminars when administrative accounting is done on basis of FTES

iv. The lack of release time for the graduate coordinator. Despite the lengthy list of duties, release time for the graduate coordinator was discontinued in Fall 2003. Lack of sufficient workload release negatively impacts recruitment, program development and program assessment.

c. Insufficient resources for support of graduate students
   i. Compensation for TAships is too low as a mechanism to support graduate students, impacting recruitment and successful completion of degrees.
   ii. University Scholarship deadlines precede graduate application deadlines precluding scholarship support for entering graduate students.

2. Address concerns about graduate curriculum, including development of new courses.

3. Insufficient university support for or understanding of resources and support needed to sustain research activities impedes the department’s ability to sustain and improve the graduate program.
   a. Office of Research and Sponsored Projects is understaffed
   b. No release time or time matching possible when faculty receive research grants (No WTUs are assigned for research related activities at all within SSU/CSU model).
   c. Insufficient dedicated space for graduate student and undergraduate research.

Areas of Special Concern
We view our single greatest concern as defending and maintaining a culture within the university that recognizes the importance of graduate student and faculty research to the greater mission of the university and sustaining mechanisms that provide resources and faculty workload that encourage faculty participation and recruitment of graduate students.

1. One important component of the graduate program is the role that graduate students play in instruction, mentoring and interaction with the undergraduate students. We see this component of the graduate program as being extremely beneficial to our undergraduates as graduate students provide undergraduates the opportunity for a higher level of academic preparation than possible without such programs or courses.
   a. Graduate students increase the academic diversity on campus.
   b. Graduate students are closer to undergraduates in age or academic experience. This feature makes it easier for undergraduates to see options beyond their bachelor’s degree, such as work towards an advanced degree.
   c. In our program, graduate students may take some elective upper division courses. Alternatively, seniors may be allowed to take selective graduate classes. This mixing provides a different academic dynamic for the undergraduates as they see the level of achievement required of graduate students and how the subject matter can easily be carried to a higher level.

2. External funding is critical to support research experiences for both graduate and undergraduate students as well as providing support to basic laboratory instruction. There is no university, school or department budget to purchase or maintain equipment used in instruction. Currently a large proportion of the equipment used in undergraduate instruction is purchased using external funding acquired by individual faculty efforts in grant writing. The Office of Research and Sponsored Programs (ORSP) and the Chief Research Officer (CRO) are the primary mechanisms for facilitating these grant efforts.

3. Critical to establishment of faculty research programs and acquisition of external funding is the start-up funds available for new faculty. Startup funds in the Department of Biology at SSU are insufficient to competitively attract and support the level of scholarship required to maintain the
quality of the faculty in a high demand field such as biology. For example our last 4 hires received an average $16,000 in start-up funds.

**External Review**
The graduate program was reviewed by Dr. Ed Connor of San Francisco State University (SFSU) in Fall 2009. He wrote in part:
"The single greatest strength of the Department of Biology at Sonoma State University is its excellent, engaged, and committed faculty. This is what makes the graduate program in Biology possible and insures the excellence of the undergraduate program as well. Any weakness of the Graduate Program in Biology stems predominantly from the lack of support provided by the University rather than issues that can be corrected by the faculty in Biology. The University should: 1) provide more workload credit to faculty for their role in mentoring of undergraduates and graduate students, 2) provide adequate release time for the Graduate Coordinator, 3) provide more funding for graduate students teaching assistantships, 4) streamline the grant submission and the procurement process, 5) increase the number of and provide adequate start-up funds for faculty in cell and molecular biology, 6) insure that greenhouse and animal care facilities are improved and expanded, 7) develop mechanisms for research or adjunct faculty to participate in the Biology Department, 8) encourage, not inhibit cross-college collaboration in teaching and research, and 9) reward an excellent department with greater autonomy and its accompanying responsibilities."

**Response to external review and self study**
The majority of the recommendations of the external reviewer were to the University and School. The Department of Biology desires to work with the Administration to address these issues. The one suggestion of the review that could be addressed by Department action was the recommendation to streamline the undergraduate curriculum, in terms of overall units required, to allow greater faculty participation in the graduate curriculum and student research. The Department will consider this suggestion as part of the undergraduate program review which is in progress. Based on the external review and self-study, the Department of Biology has generated the following action items:

**Action items for the short-term**
1. Make every effort to continue to offer 2 graduate seminars per semester as part of normal faculty instructional workload.
2. Increase faculty efforts for external grant support for graduate students to offset current loss of TA sections and potential loss of fee waivers in response to the budget crisis.
3. Advocate for return of IDC to the department to help support graduate research expenses and create research infrastructure.
4. Explore strategies for developing office space for use by graduate students.
5. Progress from development to implementation of assessment tools for the graduate program.
6. Increase compliance with recent revisions to graduate policy through a mandatory retreat of graduate faculty.

**Action items for the long term**
1. Seek return of release time for the Graduate Coordinator position.
2. Make a strong departmental case for new hires with research programs in areas of programmatic deficits.
3. Explore workload mechanisms that acknowledge the extraordinary time commitment necessary for supervising publication quality student research and encourage faculty to accept graduate students.
4. Explore mechanisms for increasing institutional support for graduate students.

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D. Crocker, Program Coordinator R. Whitkus, Department Chair