Program Name: General MA in Biological Sciences

Faculty Member(s) Responsible for Data:
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Enid Gonzalez
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Criterion 1: Quality of Curriculum, Instructional Personnel, and Curriculum Delivery

The General M.A. Program in Biological Sciences maintains a dynamic curriculum that is supported primarily by full-time tenured and tenure-track faculty hired into the department with both a broad training in Biological Sciences as well as advanced training in their chosen specialization. Our faculty readily embrace change and the incorporation of technology in the classroom, the field, and the laboratory.

Contemporary Curriculum

Our graduate program in the Biological Sciences encompasses several rapidly changing disciplines, and the General M.A. program in Biological Sciences must be responsive to current research and discovery in order to provide masters-level students with the most relevant academic knowledge and research skills. For instance, advances in scientific research have revealed the essential role of molecular biology in all areas of the life sciences. To address changes such as this and others, the Department of Biological Sciences recently restructured its programs and courses, including the addition of two new masters-level programs: the General MA in Biological Sciences that is discussed in this document, and the MA in Biological Sciences, Stem Cell Concentration. The first cohort of students in these programs matriculated into the university Fall 2009. In addition to these programs, we have significantly enhanced our two-course (BIO297a/BIO297b) graduate teaching assistantship program that now engage our students in a significant amount of pedagogical research and assessment training along with hands-on training in the classroom. As well, two new team-taught research methods courses (BIO 221a, BIO221b) were also created that our students take in their first year to prepare them for more advanced methods that they may use in their independent research projects. Our M.A. students have enrolled in each of these new courses.

Faculty (and staff where appropriate) Qualifications

All seventeen full-time faculty and six part-time faculty members that have taught graduate courses in the department of Biological Sciences since 2006 have a Ph.D. in specializations aligned with their teaching assignment. Most faculty members also have post-doctoral experience and professional training directly related to their area of specialization within the biological sciences.

Percent of Instruction by Full-time Faculty

Our graduate program is highly integrated. Students in our various graduate concentrations/programs take many of the same courses, especially in their first year. Therefore it is not possible to accurately calculate the proportion of full-time to part-time faculty in each of our separate graduate concentrations/programs. The data for all of our graduate courses for the 2010-2011 academic year is as follows: the total number of full-time and part-time WTUs devoted to non-supervisory graduate courses in Biological Sciences was 36 (18 WTUs each semester). Of those, 30 WTUs were taught by full-time faculty and 6 WTUs by part-time faculty. Therefore, 83% of all of our non-supervisory graduate courses were taught by Full-Time faculty (FactBook, Fall 2011 Appendix A). Note: Of the 6 Part-time WTUs, 3 were in the area of Cellular & Molecular Biology, and 3 were in the area of Ecology. Both courses benefited from having a professional working in the discipline teach the course (e.g. BIO 273: Advanced Fishery Biology and Management was taught by a Senior environmental scientist from the California Department of Fish and Game).

Use of Technology, as appropriate for discipline

Technology is at the very core of the biological sciences and its use is essential to prepare our graduate students to acquire scientific data in today’s high-technology setting, and for successfully training them so that they can excel in the growing Science, Technology, Engineering and Mathematics (STEM) workforce.

- We require all of our graduate students to use statistical analysis in their thesis work and research. As such, they use the latest versions of software available including SPSS. Additionally, many of our faculty and students use Mathematica for computer statistics and modeling.
Educating our graduate students on current research technology specific to their chosen discipline is deemed critical by our faculty and is therefore imbedded in the coursework of their first year of study. In the General MS Program in Biological Sciences, students either take BIO221A. Cell and Molecular Methods and Techniques or BIO 221B. Methods in Ecology, Evolution and Conservation, which covers:

- Advanced molecular technologies including conventional and epifluorescent microscopy, flow cytometry, real-time PCR, and bioinformatic programs
- Advanced field technologies that include GPS, remote sensing, and complex graphical analyses programs
- Real-time digital data gathering and sharing systems, including human-based data acquisition
- Wireless streaming and cyberlearning technologies, such as wiki-based social learning, instant messaging, social networking and social bookmarking

Student will also be exposed to varying technologies depending on their chosen field of specialty and design of their research project. These techniques will vary among all students in the General M.A. Graduate Program in Biological Sciences. These may include, but are not limited to, the following:

- Advanced methods in cell culturing techniques
- Advanced methods in molecular ecology
- Advanced methods in molecular diagnostics of human diseases
- Advanced methods in microscopy, involving epifluorescence, confocal, and light microscopy
- Techniques for safely catching and handling animals for data collection and the permitting requirements
- Protocols for data gathering in museum collections
- Laboratory animal care and the permitting procedures for research on animals
Criterion 2: Clearly Developed Learning Outcomes**

Although the General M.S. graduate program in Biological Sciences has been in existence for decades, the General MA program is quite new. Our first student started the program Fall 2009, and graduate Spring 2011. All of the policies for our program and the requirements for our graduate students are well detailed and organized in our 36 page comprehensive Graduate Program Handbook that is available online [http://www.csus.edu/bios/Students/2010GradProgHandbook%2010-05-20.pdf] with a prominent link to it from our departmental website. Thus, both current as well as prospective students to our program can obtain information on their course of study with expected learning outcomes and assessment of these. Although a formal list of “Learning Outcomes” is not expressly stated in our Graduate Program Handbook, they are inherent in the goals and requirements of our program, and individual learning outcomes are stated in the syllabi of our graduate courses [http://www.csus.edu/bios/CourseWebPages.html].

Over the last decade, we have made curricular and program changes to all of our graduate programs approximately every three years. Most of these changes have been based upon a) the outcomes assessment of our students as they progress through a three-tiered assessment process detailed below, b) both formal and informal survey’s of the regional workforce, c) changes in funding/support for our programs, and d) faculty retirements/new hires that have enhanced the expertise of the faculty in our programs. It is based upon these results that we created the MA degree program.

Clearly Articulated Program Links to Campus Baccalaureate Learning Goals

Not applicable to the General M.A. graduate program in Biological Sciences.

Updated Plan that Clearly Identifies Program Learning Goals, Assessment Strategies, and Processes by Which Data Inform Program Curriculum Decisions

Students are required to have a commitment of a faculty advisor prior to acceptance into our General M.A. graduate program in Biological Sciences. They are also sent a link to the Graduate Program Handbook in their acceptance letter, and are required to sign a commitment to keep appraised of the policies and requirements of the program that are available and regularly updated on our web site.

All students in our program engage in a three-tiered assessment process.

- **First semester**: BIO 220-Introduction to Scientific Inquiry. Graduate-level introduction to scientific inquiry in the biological sciences. Students learn to apply the scientific method, critically evaluate the scientific literature, initiate their graduate project, and develop written and oral scientific presentation skills.

- **Advancement to Candidacy**: After the first year of study, and within a year of graduation, students are required to Advance to Candidacy. As stated in the Graduate Program Handbook, “The Advancement to Candidacy process serves to ensure that a student is qualified for and making good progress toward successfully completing the Master’s degree. It also provides the student’s Supervisor Committee and the Graduate Committee an opportunity to provide timely feedback to the student regarding the scientific merit, feasibility, and scope of the proposed research project.” Furthermore, it is a formal assessment of the student’s progress towards the learning outcomes first introduced in the BIO 220 course.

Project Submission and Project Seminar. The Project, as stated in The California Code of Regulations: Title 5 Education, Section 40510, and our Graduate Handbook is: “a significant undertaking appropriate to the fine and applied arts or to professional fields. It evidences originality and independent thinking, appropriate form and organization, and rationale. It is described and summarized in a written abstract that includes the project’s significance, objectives, methodology, and a conclusion or recommendation.”

This culminating written document and the culminating Project Seminar are our final assessment of student progress towards attaining the learning goals that were set forth in BIO 220 their first semester.

During the Project Seminar, the student orally presents the general nature of the Project to the Graduate Advisor, members of the Supervisory Committee (made up of two additional faculty or professionals with
Section: Clearly Developed Learning Outcomes

expertise within the discipline of the student’s research project), and the Graduate Committee (made up of three faculty in the Department of Biological Sciences, including the Graduate Coordinator). The seminar is also advertised and open to the public; it may be attended by anyone who wishes to attend. The student is then expected to answer questions on the Project. Following the question and answer period, the Supervisory and Graduate Committees will then grade the student’s seminar as “acceptable” or “unacceptable.” As stated in our Graduate Program Handbook, this assessment will be made using the following criteria:

a. The successful completion of the thesis/project objectives as stated in the Abstract of the Proposed Thesis/Project
b. Presentation;
c. Organization;
d. Explanation of data/results;
e. Articulation of the broader significance of the work and its relationship to the pertinent literature in the field
f. Ability to effectively respond to questions from the audience.

If a student’s seminar is deemed unacceptable, members of the Graduate and Supervisory Committees inform the student of her/his deficiencies and what the student must do to present an acceptable seminar. If a second seminar is provided but is also not accepted, the student is permanently removed (disqualified) from the Department of Biological Sciences’ graduate program.

The General MA is a rigorous program, and requires a substantial amount of independent work. It is too early to tell the success rate of this program, but we are tracking the numbers of students that are accepted into the program, their area of interest within the field of Biological Sciences, and their successes.

External Assessment and Accreditation Outcomes, where appropriate

Our graduate program does not require external assessment, nor do we have accreditation outcomes to meet.
Section: Advising Program and Graduation Success

Criterion 3: Advising Program and Graduation Success

Although a very new program that began in 2009, the General M.A. Program in Biological Sciences maintains a dynamic curriculum that is supported primarily by full-time tenured and tenure-track faculty hired into the department with both a broad training in Biological Sciences as well as advanced training in their chosen specialization. To better serve its graduate students, the Department of Biological Sciences began a process of revising its graduate programs in fall 2006. Since that time, the Department has made significant changes in its admission requirements, procedures, and courses. In particular, the application procedure was streamlined by requiring submission of a supplementary departmental application, instituting a process to match students with available faculty/resources, and establishing one application period per year. Together, these changes have allowed the department to manage its application process more effectively, maintain a manageable and consistent number of students in a cohort, and provide matriculated students with improved faculty support and advising. Each student is matched with a faculty advisor prior to matriculation into the program, and it is this advisor that formally shepherds the student both in academic advising as well as research advising until the student graduates.

Graduation Rate

The General M.A. program is designed to take a minimum of two years to complete. Our first student graduated within two years, Spring 2011.

Overall, the graduate students in the Department of Biological Sciences achieved a high rate of success in graduation. Of students that graduated between Fall 2006 and Fall 2011, 31% completed their degree within 3 years, 19% completed within 4 years, 17% finished within 5 years, and 21% took 6 years to complete their degrees. Of the 100 students who have been enrolled in the M.S. graduate program at any time since fall, 2006, 57% have graduated, 40% are currently enrolled, and 3% left the program without earning a degree.

Distribution of Advising Responsibilities Among Faculty Members

Three members of the Department of Biological Sciences serve as the Graduate Committee; one member of the committee is the Graduate Coordinator. The Graduate Coordinator, along with the Graduate Secretary in the Department, serves as a nexus for student contact and information. The responsibility of serving as advisors and mentors to graduate students is voluntary among faculty in the Department of Biological Sciences. Between 2006 and 2012, 83% of our full-time faculty in the Department of Biological Sciences served as Graduate advisors/research mentors for our graduate students. Other faculty members from other departments, including Environmental Studies and Geography, as well as several research collaborators from the region (i.e. UC Davis, VA Hospital, Dept. Fish and Game) serve as members of student Supervisory Committees and are an important source of supplementary support for our graduate students.

Proactive Advising Contact with Students to Assure Progress to Degree

The Department of Biological Sciences revised many aspects of its graduate program and a number of these changes were designed to provide proactive advising contact. The current policy is in place is as follows:

- Prior to application, students are required to communicate with departmental faculty and identify a faculty member who agrees to serve as their graduate advisor for the entire duration that the student is matriculated in the program.
- Students are informed upon acceptance of the Department's *Graduate Program Handbook* that is prominently linked to our webpage (http://www.csus.edu/bios/CurrentGradStudents.html) and serves as a roadmap and advising guide.
- Students are required to maintain continuous contact with their graduate advisor who is available for both academic as well as research advising.
Section: Advising Program and Graduation Success

Perhaps the most key proactive advising process the Department utilizes centers around student Advancement to Candidacy (detailed in the Graduate Program Handbook). This is a major milestone for students in our program in that it ensures that they are on the path to success in our program, and that their path to completion is clearly defined. In preparation for their Advancement to Candidacy, students write a research proposal that is reviewed by the student's Supervisory Committee (made up of their graduate advisor and two other faculty members). Members of the student’s Supervisory Committee and members of the Graduate Committee attend the Advancement to Candidacy meeting. Together, these faculty review the students proposed coursework and then listen to the student present their proposed research in a formal seminar setting. Following questions and suggestions for improving the proposed research approach, faculty vote on whether or not to approve advancement. One of the key outcomes of this is approval of the Abstract of Proposed Research which serves as a clear contract defining the student’s project. Since committees change and memories may differ, this serves as a highly effective method of clearly defining the path to graduation success.

Program Roadmap to Curriculum Completion and Graduation Success

Described above.

Use of Technology to Supplement and Strengthen Program Advising Effort

Our primary tool in this area is our online Graduate Program Handbook and supporting advising materials through the Department's website. Additionally, the department is moving from paper tracking, which is a very comprehensive system of file folders and forms, to a database in ACCESS to track our students from entrance to graduation. This will strengthen our advising efforts – especially for students that are nearing the 7-year limit, and will also allow easier access to statistics for prospective students interested in applying to our program.

Post-degree success, Graduate Impact on Community

We anticipate that the General M.A. Program in Biological Sciences will serve those professionals that are interested in teaching at the Community College level, and are therefore interested in a broad-range training in the Biological Sciences. Our first graduate of the program is interested in Patent law, and plans to pursue this as a career. He also recently graduated from Law School.

Overall, our graduate students with the M.S. degree in Biological Sciences serve in all levels of public agencies, local, state and Federal as well as private industry. Our graduates serve the state in the Department of Fish and Game, Water Resources Board, Air Resources Board, and California Environmental Protection Agency (Pesticide Management). They are teachers from elementary schools to community colleges. Our M.S. Graduates in the biological sciences are also competitive in the local biotech industry. Verification for the data on the success of our graduates since 2006 can be found at [http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html](http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html) We are hopeful that our M.A. graduates will be equally successful.
Criterion 4: Strength of Teaching Performance

The faculty that teach courses and serve as graduate thesis advisors in the General M.A. program in Biological Sciences, as with all of our faculty in the Biological Sciences, are absolutely committed to excellence in teaching.

Faculty teaching in all programs in the Department of Biological Sciences are held to the same standards with regard to teaching performance. Therefore, responses relating to this criterion apply to all Biology programs.

Articulated Program Statements regarding Quality of Teaching

The Department of Biological Sciences is committed to ensuring the strength of its faculty's teaching performance. Examples of documents that include articulated statements regarding this commitment and selected excerpts from these documents are provided below.

1. Department RTP Policy: Current Department RTP Policy includes the following statements:

   *The Department of Biological Sciences places primary emphasis on Teaching Performance and shall weight performance in this category no less than 55% in the evaluation of candidates for retention, tenure, and promotion. In addition, competent teaching performance shall be the primary and essential criterion for retention, tenure, or promotion. (note: in practice, the normal weight assigned to teaching performance under current policy is 80%, a weight that is proposed to be reduced to 60% in reviews/evaluations beyond the first couple of years in residence, though still maintaining the eminence of the category).*

   *The Department of Biological Sciences is strongly committed to advancing the teaching mission of the University through classroom instruction and non-classroom activities that foster the intellectual and personal development of students.*

3. Department Hiring Policies: When hiring a new full-time tenure-track faculty member, evidence of potential for teaching effectiveness and commitment to teaching is the first consideration brought to bear by the faculty on the Search Committee, and is required by policy set forth in the Department’s Governance model. The job announcement is crafted in such a way as to attract teacher/scholars. A statement such as “teaching experience at the college level is required” is included and applications must include statements of both teaching and research interests. In paper screening selection of candidates for interview, ~40% of the weight is accorded specifically to evidence of potential for teaching effectiveness in assigned courses, including evidence of: breadth of coursework and/or experience in biology, potential for teaching lower division biology for majors and non-majors, potential for teaching effectiveness in area of specialization, and experience with diverse student groups. During the interview, candidates are asked to present a teaching seminar in addition to showcasing their scholarly work. As in the case of paper screening, at least 40% of the weight in making a hiring recommendation from among the candidates interviewed is accorded specifically to potential for teaching effectiveness.

   In part-time hiring, candidates are required to provide a statement of qualifications for the teaching assignment, and prior teaching performance evaluations are given substantial weight in rankings.

Ongoing, Meaningful Assessment of Teaching Performance of Faculty, Post-Tenure

Post-tenure, the importance of teaching performance (which is given significant weight in RTP, see above) is given the same weight in promotion from Associate to full Professor as in the earlier RTP cycle. The Department encourages continued excellence in Teaching Performance through a 5-year review process, governed by its Policy on. “Evaluation of Tenured Faculty not subject to RTP Review.”

Multiple Measures of Teaching Performance of Full-time and Part-time Faculty Members

Multiple measures include:
Section: Strength of Teaching Performance

- Student Evaluations: The Department takes great care to solicit information from students regarding the quality of our teaching. Unless a Full Professor, all faculty members, regardless of experience, are required to have all classes evaluated by students every semester. These evaluations are thoroughly reviewed in RTP and hiring (e.g. Part-time faculty) considerations. Our RTP policy specifies that: “while no minimum instructor performance rating is specified as a condition for retention, tenure or promotions, faculty being evaluated should be advised that an average instructor performance rating below 7.5 (on a 10 point scale) across all courses taught will necessitate explanation and substantial evidence of teaching effectiveness from other sources.” Faculty members being evaluated are also advised that high instructor performance ratings in student evaluations are not in themselves sufficient to demonstrate teaching effectiveness. Faculty members who have completed the promotional cycle (Full Professors) are also required to have their classes evaluated (at least two courses per year, although most continue to have every course evaluated every semester).

- Additional Measures of Teaching Performance: In all RTP Periodic Evaluations and Performance reviews of full-time faculty, candidates must provide a) a reflective statement on teaching (“Overview of Teaching Effectiveness”), and b) Course syllabi and samples of course materials produced by the candidate for courses taught during the semester preceding the evaluation/review. In addition, after the first two years in residence, full-time faculty must provide evidence of additional contribution to the teaching mission of the Institution, which extends beyond their effectiveness in classroom teaching. Examples include: evidence of a positive impact upon the lives and achievements of students, evidence of extra assistance for student learning, revisions of course laboratory exercises, evidence of supervision of students engaged in graduate research or undergraduate research, service learning, internships, volunteer work, and evidence of receiving teaching awards or honors, or other noted contributions to the curriculum.

Part-time faculty do not play a large role in the course-work instruction of our graduate students. In 2010-2011, only 12% of our non-supervisory graduate WTU were accounted for by Part-Time faculty. That equates to two courses, both of which were enriched by the training that the faculty member brought from the workforce. All tenure-track faculty members are required to participate in reviewing and ranking part-time applications, with priority given to applicants with demonstrated teaching effectiveness. Transcripts, a statement of interest and teaching philosophy are required and are rigorously assessed during the hiring process.

Systematic Program Attention to Problematic Individual Teaching Performance

Full-time faculty members are addressed primarily through the RTP process, where a letter is generated in which each candidate’s strengths and possible areas of improvement are articulated. This feedback allows the candidate to see where Teaching Performance needs improvement. In addition, the Department's RTP policy requires that the Professional Development Committee (consisting of the RTP Committee Chair, Department Chair, and another senior faculty member) follow-up with the candidate in a meeting at the completion of each evaluation cycle.

Part-time faculty are invited to meet with the Committee to discuss any aspects of their evaluation, and are referred to the Center for Teaching and Learning if they are interested in working on specific aspects of their teaching.

Perhaps, most importantly, the Department adheres to the view that problematic teaching performance can be avoided altogether by highly selective hiring, and a systematic engagement of faculty in activities and discussions with the specific intention of improving curriculum design and improving teaching performance.
Criterion 5: Program History and Development Status

The General M.A. program in Biological Sciences is a very new graduate degree program for our department. It was developed by our faculty over several semesters, and approved by the University in 2009. One of our main goals in developing this program is to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the MA and MS programs is identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the MA program is a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the MA program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our MA program serves an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.

Level of program development (e.g. young, growing, mature)

The curriculum and course offerings of our graduate program as a whole are revised regularly to meet with the dynamic nature of Biological Sciences and the needs of the regional workforce. Approximately fifteen years ago, the Department of Biological Sciences revised the core curriculum of the General M.S. Program in Biological Sciences, and added a new “Cellular and Molecular Concentration” to address the needs of the growing Biotechnology workforce in our region. In 2009, two M.A. degree programs were also added, the General MA, and an MA in Stem Cell biology in an effort to continue to address the needs of the Sacramento region.

In fall 2006, the Department made significant changes in its admission requirements and procedures for all of the programs offered in an effort to provide matriculated students with improved faculty support and advising. In 2011we continued to update our program, enhancing and stream-lining the graduate curriculum for both our MA and MS programs. These changes are listed below.

- **Admissions requirements and Application Procedures:** Admission requirements were revised to be less restrictive in specific coursework requirements but more rigorous by adding a GRE Subject Test requirement, an admission preference to applications obtaining faculty sponsorship and letters of recommendation. The application procedure was streamlined by requiring submission of a supplementary departmental application, instituting a process to match students with available faculty/resources, and establishing one application period per year; together these changes have allowed the department to manage its application process more effectively, maintain a more manageable and consistent number of students in a cohort, and provide matriculated students with improved faculty support and department resources.

- **Changes to the curriculum:** To reflect the actual time and effort graduate students in the Department dedicate to their thesis/project research and writing of their thesis/project, the Department increased the number of research (Bio 299), thesis (Bio 500), and project (BIOS02) units required for the degree relative to the number of coursework units. Additionally, a new team-taught research methods course was created and several courses merged or revised to better reflect the current state of the respective disciplines.

- **Supervisory Committee Composition:** To allow students to benefit from expertise beyond its own faculty, the Department revised its policy on composition of a student’s supervisory committee. A student’s supervisory committee may now include an “outside” member who has earned doctorate in Biological Sciences or a related field and who is not a tenured or tenure-track faculty member in the Department of Biological Sciences at CSU Sacramento.
In making the changes listed above, we have remarkably improved our graduation rate in our M.S. program from 58% in 2000 to 88% in 2006 for students within 5 years of their matriculation into our program.

**Ability of program to adapt to current demands**

The Graduate Program in Biological Sciences has adapted quickly to current demands as follows:

- Admissions Policy- A cohort of students is accepted only once per year and students are required connect with a research mentor prior to admission.
- Curriculum changes to include team-taught courses in students’ area of specialization within the concentration.
- Development of two new MA (non-thesis) degree programs (established in 2009):
  - **Grant Proposal Track**—The Grant Proposal track is a non-thesis degree option designed for students pursuing non-research based careers in biology, including education, science writing, science illustration, science law, science policy, and the health professions.
  - **Stem Cell Concentration (Professional Science Master’s Program)**—The Stem Cell concentration provides support for 10 graduate students per year through an external grant from the California Institute for Regenerative Medicine. A collaborative effort between CSU Sacramento and UC Davis, the program trains students for careers in stem cell research or biotechnology.
- Revised supervisory committee structure open to Ph.D.-level scientists outside of the department and University; this expands the expertise outside of the department that students can draw experience from. Part-time and Full-time collaboration with agencies outside of the University

**Future goals of program**

As this is a very new program (in 2011, we graduated our very first student in this program), we are just now getting data from both our prospective as well as our matriculated students that will help us formulate our future goals for this program.
Criterion 6: Impact, Justification and Centrality to University Mission

Centrality to the University’s Mission: Like all programs offered by the Department of Biological Sciences, the General M.A. in Biological Sciences advances the University’s mission through its disciplinary focus on preparation of the workforce needed to address scientific issues affecting the region and the state and its pedagogical emphasis on the development of intellectual and practical skill sets (e.g., inquiry and analysis), which are broadly applicable to understanding and addressing societal issues beyond the realm of science.

Unique Program Characteristics/Adding Distinctiveness to our Campus

The closest public university offering a masters degree in a biological discipline is UC Davis. UC Davis offers an M.S. with either a thesis or an exam option as its culminating requirement. They do not offer an M.A. in Biological Sciences. Additionally, UC Davis offers a variety of Ph.D. programs within the Biological Sciences. These doctoral programs span departments within the discipline or represent individual departments. As the main goal of University of California campuses is to train Ph.D.-level scientists, very few offer a stand-alone Master of Science program. Typically programs prefer students to enter as Ph.D. students, however provisions are made on a ‘case-by-case’ basis within individual departments to 1) allow students to enter as Master’s level students or 2) for students to leave with a Master’s degree in hand in case they should leave the Ph.D. program prior to completion of the program. This leaves working professionals, including teachers, government policy makers, and Bachelor’s level scientists few options to continue onto Master’s- level work, without committing to a Ph.D. program.

The General M.A. in Biological Sciences was developed by the Department of Biological Sciences at CSUS in 2009 to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the M.A. and M.S. programs is identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the M.A. program is a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the M.A. program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our M.A. program serves an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.

Most of the students in the Biological Sciences M.A. program work-full time, and because of this employment they bring a breadth of knowledge and numerous resources to our program. In addition, the majority of our course offerings are offered during evenings and the lunch hour. Our working students devote their evenings and weekends to work on their project research.

Additional Information

To facilitate time to graduation and effectiveness of advising, students entering the General M.A. in Biological Sciences are required to identify a faculty member who agrees to serve as their graduate advisor. In addition, students are admitted each year as a cohort of students. This cohort is required to take BIO 220-Introduction to Scientific Inquiry and either BIO 221A-Cell and Molecular Methods and Techniques or BIO 221B—Methods in Ecology, Evolution, and Conservation depending on the nature of the student’s research. All students in the program are required to develop a project and present progress and completion of the project in a formal setting. In total, the program is accessible, proactive, and rigorous in its content and delivery of a quality graduate education and serves a critical role in the greater Sacramento community.
Criterion 7: External Demand for the Program

How does the program support community engagement with the campus? What is the demand for the program’s resources and expertise? What are the local trends in enrollment? What is the demand from employers, or from graduate schools?

The demand for trained biologists and their roles and impact are clearly described in the 2010-11 Bureau of Labor Statistics Report (http://www.bls.gov/oco/ocos047.htm). In brief, the report concludes that: "Employment of biological scientists is expected to increase much faster than the average for all occupations although there will continue to be competition for some basic research positions." The demand cited in the report spans the breadth of biology (which is a very broad field). Due to our location, virtually all of the high impact areas of growth cited in the report are present in our area--from biotech to health care, and from academia to environmental science. There are a large number of local, state, and federal government positions in our region that require trained students trained across the breadth of biology.

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NOTE: Data in this table are rounded. See the discussion of the employment projections table in the Handbook introductory chapter on Occupational Information Included in the Handbook.

http://www.bls.gov/oco/ocos047.htm

The General M.A. in Biological Sciences was developed by the Department of Biological Sciences at CSUS in 2009 to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the M.A. and M.S. programs is identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the M.A. program is a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the M.A. program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our M.A. program serves an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.

As the General MA in Biological Sciences is quite new, we are just now assessing the impact of this program in our community, and evaluating the real demand as determined by the number of students that matriculate into the program. It is too early to address these aspects of the program at this time.
Criterion 8: Program Size, Scope (note to reviewer: header is incorrect for this section)

Across its programs, the Department’s graduate curriculum covers a wide range of disciplines within the biological sciences, ranging from molecular and cellular biology to ecology, evolution and conservation. Not only do its course offerings span multiple levels of organization in the discipline, but they also integrate current methods and techniques in the biological sciences. Its courses also include representation of different taxonomic groups, including plants, animals, microbes and fungi.

Although the collective expertise of the Department’s 18 Full-time and 3 FERP faculty Faculty span a wide range of disciplines and techniques, it has lost a number of key faculty positions – and thus expertise – over the past several years. These personnel losses have placed significant challenges on its current faculty to meet the academic needs of its students. In addition, while the Department has managed to provide a basic level of resources and support for its curriculum, the graduate program continues to be challenged by the continued erosion of resources available to its faculty and students. Despite all of this, we have managed to continue offering what we believe is a graduate program for our students that clearly values excellence in teaching and in research, albeit on a much smaller scale than what we once had.

Number and types of degrees, concentrations, awarded

As of Fall 2009, the graduate program in Biological Sciences began offering the MA degree. We Graduated our first General M.A. student two years later last Spring 2011. This student is now an Analyst at California Public Utilities Commission, has completed a law degree, and is studying to take the Bar exam, with a desire to become a patent attorney for IP and biologics.

<table>
<thead>
<tr>
<th>Graduate Degrees Awarded¹</th>
<th>AY 06-07</th>
<th>AY10-11</th>
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<tbody>
<tr>
<td>MS</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>General</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Ecology, Evolution and Conservation</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Molecular and Cellular Biology</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>MA</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>General - Grant proposal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Stem Cell Concentration</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

¹ first MA degree conferred Sp ’11;
Data for this table is from SacVault

Annual FTES in major, minor, certificate elements of program

<table>
<thead>
<tr>
<th>Matriculated Graduate Students</th>
<th># Students¹</th>
<th>%</th>
<th>AY FTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>General, Biological Sciences (MS)</td>
<td>12</td>
<td>19</td>
<td>10.5</td>
</tr>
<tr>
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<tr>
<td>Molecular and Cellular Biology (MS)</td>
<td>10</td>
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<td>8.7</td>
</tr>
<tr>
<td>General, Biological Sciences (MA)</td>
<td>2</td>
<td>3.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Stem Cell (MA)</td>
<td>23</td>
<td>36.5</td>
<td>20.1</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100</td>
<td>55²</td>
</tr>
</tbody>
</table>

¹ Data from SacVault for Spring 2012, ² Data from FactBook AY 10-11
Criterion 9: Internal, Non-major Demand for the Program

The courses taken by our graduate students in the General M.A. program in Biological Sciences span the spectrum of all of our Biological Sciences programs, and are therefore taken by students in all of our Graduate Programs (MS General; Ecology, MS Evolution and Conservation Concentration; MS Molecular and Cellular Concentration; MA Stem Cell; MA General) in the Department. Each year, one or two Biochemistry Masters’ degree students from the Chemistry Department enroll in our cellular/molecular-based graduate elective courses. Most recently they have enrolled in BIO 224. Genomics, Proteomics, and Bioinformatics, and BIO245: Host Pathogen Interaction.

Service courses (accompanying AY FTES)

The Department of Biological Sciences teaches BIO633, a course designed for students enrolled in the Doctor of Physical Therapy Program. On average, thirty-four Physical Therapy graduate students enroll in this course each Fall Semester which equates to 5.65 FTES each fall when the course is taught.

From the University course catalog: BIO 633. Human Gross Anatomy for Physical Therapists. Study of the gross anatomy of selected regions of the human body. Emphasis will be placed on musculoskeletal, neurovascular and anatomy of the joints of the back, thoracic wall, abdominal wall, upper limb and lower limb. Anatomical relationships will be reinforced through study of cross-sectional anatomy. Lecture two hours; lab three hours. Note: Course designed for students enrolled in the Doctor of Physical Therapy Program. Prerequisite: BIO 22 or instructor permission. Corequisite: PT 600, PT 602, PT 608, PT 630. Graded: Graded Student. Units: 3.0

GE courses (accompanying AY FTES)

Not applicable to graduate our programs.

Research resources

The Department of Biological Sciences’ on campus arboretum, greenhouses, and CIMERA cellular/molecular research facility, as well as our autoclaves provide resources to individuals within the College of Natural Sciences and Mathematics, across campus, and in the Community. As well, the Faculty provide guidance for students in other departments (i.e. Chemistry, Anthropology, Criminal Justice, Psychology, Education), especially with regard to research that may involve molecular biology, genetics, or science education.
Section: Quality of Program and Resource Utilization

Criterion 10: Quality of Program and Resource Utilization

The Graduate program, as a whole in the Biological Sciences, has been functioning for the last several years with seemingly minimal institutional support. Despite this, we have been very productive.

Faculty productivity in non-teaching areas

Scholarly and Creative Activity: The Department embraces a broad definition of scholarship, similar to that initially described by Ernest Boyer to include the scholarship of discovery, the scholarship of integration; the scholarship of application; and the scholarship of teaching. Each faculty member is expected to pursue a program of scholarship that is reflected by accomplishments that: 1) contribute to the development or creation of new knowledge, OR 2) contribute to the critical analysis and review of knowledge within disciplines or the creative synthesis of insights contained in different disciplines or fields of study, OR 3) apply findings generated through the above to solve real problems in professions, industry, government, the university, and/or the community, OR 4) contribute to the development of critically reflective knowledge about teaching and learning. This enables the Department to contribute to the University’s multi-faceted mission by encouraging faculty to apply their varied talents, interests, and capabilities in ways that ensure that all facets of this mission receive substantial attention.

Grant Applications:

Since 2006, faculty members in the department of Biological Sciences (83% of whom serve the M.S./M.A. in General Biology) obtained $14.67 million in grant funding (source: Research and Contract Administration). In addition, faculty members that serve our graduate program secured over $1 million in donated equipment and supplies (e.g. cell culture hoods, incubators, analysis kits, a mass spectrometer, etc.).

Since 2006, Faculty in the Department of Biological Sciences that supported the graduate program through their research and teaching submitted over 48 grants for research-related projects. Of those, 42 were successfully funded, and secured both internal and external support for research in our program, much of this involving students. (Source: Biological Sciences faculty, [http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html](http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html)).

Scholarly and Creative Activity: Since 2006, faculty members in the department have collectively made over 120 oral and poster presentations to more than 40 different recognized, national professional organizations (i.e. American Society for Microbiology, and American Association for the Advancement of Science). Finally, faculty members that support our Graduate program through research and teaching have published 35 articles in refereed journals since 2006. (faculty reporting [http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html](http://www.csus.edu/bios/temp/quartile_1290847qwel;rj.html)).

Service to the Community and to the Profession: The Biological Sciences faculty are also well-represented in professional societies and in the community, serving leadership roles such as: Grant Reviewers for the National Science Foundation (several faculty), Editorial Board member, Advances in Physiological Education, Chair, American Physiological Society Awards Committee; Fall Meeting Co-Chair, Northern California American Society for Microbiology; Program Leader, 4-H “On the Wild Side” program; Team Leader, Sacramento Wildlife Count; President, CSU Biology Council; Faculty Liaison and Steering Committee member, HAPS Institute for graduate study; and the Project Director for the California Legacy Project which was developed in collaboration with numerous state and federal agencies to “help Californians make the important decisions about conserving and protecting the state's bountiful working lands and magnificent natural resources.”

Service in University Governance: Faculty members from Biological Sciences are well represented on committees at the College and University levels. In the current year, examples include: Graduation Initiative Steering Committee, Faculty Senate Executive Committee, Academic Information Technology, CSUS Student Research Competition, Animal Care and Use, Program Review Oversight Committee, University Grade Appeal

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Committee, as well as every College-level committee. Faculty members from our department have also chaired or served on search committees for numerous administration positions and directorships across campus.

Working with other programs

Our faculty that are involved in graduate student research and teaching are highly collaborative, working with other faculty within the department, college, and across campus. The faculty and staff have been involved with a number of collaborative programs including Academic Talent Search, Expanding Your Horizons (a program designed to encourage young women to become involved in STEM disciplines). Several faculty are also involved in CREST, the CSUS Center for Regional Environmental and Science Technology and CIMERA (Center for Interdisciplinary Molecular biology: Education, Research and Advancement). Our faculty members collaborate extensively with Chemistry Department faculty and faculty in the Environmental Science program on research, service and instructional projects.

Our faculty members have extensive collaborations both locally, nationally, and internationally, including with UC Davis faculty members, VA Hospital research faculty, scientists in Oklahoma, Florida, as well as the far reaches of the South America, Central America, Africa (Tanzania and Kenya), and Europe including a recent Senior Fulbright fellowship of one of our faculty in Berlin, Germany.

Effective sharing of resources

Faculty share resources for both research and teaching. Most faculty share office space (55% of full-time and 100% of part-time), and our research faculty members share lab space and equipment (e.g. microscopes, models, centrifuges, incubators, safety hoods, field collection equipment and field vehicles). The CIMERA cellular/molecular facility was devised and remains a shared facility available to all faculty across the college and the campus whose investigations or teaching utilize cell and molecular technologies. The California Institute for Regenerative Medicine grant that was recently renewed to support our MA Stem Cell program pays one-half of our dedicated cell and molecular Instructional Staff position, and heavily supports the BIO 221a methods course that more than half of our graduate students take. Additionally, the Department of Biological Sciences’ on campus arboretum, greenhouses, as well as our autoclaves provide resources to individuals within the College of Natural Sciences and Mathematics, across campus, and in the Community. As well, the Faculty provide guidance for students in other departments (i.e. Chemistry, Anthropology, Criminal Justice, Psychology, Education), especially with regard to research that may involve molecular biology, genetics, or science education.

Finally, the curricula at the graduate level is structured to be efficient such that few courses stands alone. That is, nearly all courses may be used in more than one program. For example, the BIO220/BIO221 introductory graduate courses required in the Ecology, Evolution and Conservation concentration also serves as the introductory course for STEM and General Biology concentrations. In addition, based on past enrollments, a two-year schedule of courses is generated each year, and the Department has a formal class scheduling policy, which prevents scheduling conflicts among required courses in a curriculum.

With regard to effective resource utilization, one benefit of the General MA program over our M.S. programs is that it effectively trains a percentage of our graduate students without the increased drain on resources that additional bench or field research has when students undergo their independent thesis research.

Facilitating student access to programs.

Through the numerous activities within the community and professional societies, faculty that serve in the graduate program in the Biological Sciences are well informed of programs and opportunities for our students, and are quick to disseminate this information. Much of this occurs through our student clubs and organizations, within each graduate research group, and through individual graduate advising by faculty mentors/graduate advisors that shepherd each of our graduate students on a one-to-one basis.
Section: Quality of Program and Resource Utilization

Information regarding our graduate program is primarily disseminated via our Departmental website http://www.csus.edu/bios/ which has a well-marked link to all things associated with our graduate program (including the Graduate Handbook (http://www.csus.edu/bios/Students/2010GradProgHandbook%2010-05-20.pdf) which details all requirements of the program from admissions to graduation in 30 pages.) as well as individual faculty web pages.
Criterion 11: Revenue and Other Resources Generated by Program
This section has been written for the department as a whole, as budgetary issues are handled on a departmental level.

Enrollment-based budgetary support from University
For our program, we receive budgetary support from the College based on FTEF (for office and facilities expenses) and based on FTES (for instructionally-related expenses). Unfortunately, for the past several years, this allocation has fallen very short of what we need to provide appropriate materials for students in our classes (in 2006-07, our $$/FTES ratio was $69.63/FTES; by 2011-12, the ratio had fallen 29% to $49.70/FTES). To maintain the quality of our program, we have resorted to charging students laboratory and field trip fees for almost every course. While in some ways this may seem like an equitable way to share the cost, we are highly disappointed that students in our program are absorbing the budgetary shortfall.

Research grants, in-kind equipment donations, fundraising
Since 2006, faculty members in our program have obtained $14.67 million in state and federal funding (source: Research and Contract Administration). In addition, faculty members secured over $1 million in donated equipment and supplies (e.g. cell culture hoods, incubators, analysis kits, a mass spectrometer, etc.). This has enabled us to create state-of-the-art laboratory experiences for our students even as the technology rapidly advances and our budget has dwindled. We would be remiss if we did not mention the fact that without these donations, we would have been unable to adequately prepare our students for an increasingly complex scientific job market. We feel extraordinarily fortunate to have acquired this equipment.

Potential revenue (gifts, alumni support)
Former faculty members have been generous in their support of our facilities and students.

- Dr. Marda West, Professor of Biological Sciences from 1966-2001, generously endowed her entire estate (over $750,000) to the Department of Biological Sciences, to be used primarily for student scholarships. Every year, at least $21,000 in student scholarships are awarded to deserving Biological Sciences majors. Marda also donated her SUV to the department for collection trips and field trips. This year, when it needed repairs in excess of its worth, Marda’s fund allowed us to replace it (total cost = $22,413).
- Dr. Albert Delisle, Professor of Biological Sciences from 1956-1977, provided an endowment (currently valued at $300,000) whose interest provides yearly student scholarships ($2000 each, with at least two awards/year) and support for student research within the department that is open to all faculty members.
- Dr. David Vanicek, Professor of Biological Sciences from 1967-2000, used excess research funds to found a Biological Conservation scholarship (yearly award of $500)
- Dr. Carl Ludwig, Professor of Biological Sciences from 1949-1980, established an endowment that funds a yearly $700 scholarship to support outstanding teaching assistants
- Dr. Miklos Udvardy, Professor of Biological Sciences from 1966-1984, provides a yearly $500 scholarship to graduate students to support their research projects

Other scholarships available to students have come from alumni and other local donors:
- McDougal-Robinson ($1000) (shared with Nursing, awarded every other year)
- Josephine Van Ess scholarship - $2000/year
- Von Saltz - $2000/yr (this award, shared with English, is awarded every other year)
- Sutter Hospital scholarship for Clinical Lab Scientists: 2 @ $1000/year

Value of other services and resources provided
The department also generates at least $5000/AY from students who enroll in our courses through Open University/College of Continuing Education. This money is used to support teaching labs throughout the department.

Program Name: (M.A. Biological Sciences, General Biology)