To: Carmen Sigler, Provost
From: Dan Perales, Chair
Program Planning Committee
Re: Biology Program Plan
Date: Sept 12, 2007

CC: John Boothby, Chair, Biology Department
    J. Michael Parrish, Dean, College of Science
    Steve Branz, Associate Dean, College of Science
    Michael Kaufman, Chair, Curriculum and Research
    Bob Cooper, AVP Undergraduate Studies
    Pam Stacks, AVP Graduate Studies
    Bill Nance, Vice-Provost

In accordance with S96-10 the Program Planning Committee is submitting its report on the programs in the Department of Biological Sciences. The undergraduate programs of the Department of Biological Sciences include one BA degree in Biological Sciences and a BS degree with five concentrations, two BA degrees in “Preparation for Teaching,” two “Preparation for the Health Professions” programs and three minors, for a total of thirteen (13) undergraduate programs.

The graduate programs of the Department of Biological Sciences include one MA in Biological Sciences, one MA in Clinical Life Sciences, one MS in Biological Sciences with three concentrations, one MBT (Master of Biotechnology) degree, and curriculum for second baccalaureate pre-medical programs, for a total of seven (7) graduate programs.

The PPC agrees with the external reviewer and the College Committee that the self study should include more planning at the department level. Comparison across degrees, majors, concentrations, and minors is essential for planning. Low enrollment in some programs/courses is a concern and must be addressed as a department. Under the 2006 Program Planning Guidelines, adopted since the last self-study, specific data elements are required and will be supplied by the SJSU Office of Institutional Research for the next self study.

The PPC would especially like to acknowledge the department for making progress in assessing student learning at both the undergraduate and graduate levels. The department is ready to progress to focusing on using data to inform programmatic changes that will improve student learning.
The final step in the program planning process is a meeting with the Provost (or her designee), the Dean, and the Department Chair. The following agenda items are suggested for the meeting:

a. Eliminating or combining concentrations and/or programs with very low enrollment, so as, at a minimum, to allow scheduling of each course offering at least every two years.

b. Links between the assessment procedure, assessment results, analysis, the improvement process, and department strategic planning.

c. Methods for improving communication among faculty members in different programs; and between faculty and staff.

d. The possibility of developing Departmental RTP guidelines to supplement University guidelines. Improve mentoring of junior faculty.

e. Where resources might be found to reconfigure research space.

If the Department would like to propose other issues, please let Janette Pamintuan know so that the items can be added to the agenda.

The next program planning for Biological Sciences is scheduled to occur during the 2010/2011 Academic Year. The committee expects for the self-study in that cycle to include a comprehensive five-year plan that looks at the department as a whole, including a revenue-generated-to-resources-consumed comparison for the department overall.
1. Summary of Self Study (Fall 2005)

The undergraduate programs of the Department of Biological Sciences include one BA degree in Biological Sciences and five BS with concentration degrees, two BA degrees in “Preparation for Teaching,” two “Preparation for the Health Professions” programs and three minors as listed below:

1. BA, Biological Sciences
2. BS, Biological Sciences, Concentration in Conservation and Organismal Biology, (with emphases in botany, conservation, entomology, and zoology)
3. BS, Biological Sciences, Concentration in Marine Biology
4. BS, Biological Sciences, Concentration in Microbiology
5. BS, Biological Sciences, Concentration in Molecular Biology
6. BS, Biological Sciences, Concentration in Systems Physiology

Preparation for Teaching
7. BA, Biological Sciences, Preparation for teaching (preparation for middle and high school science teaching)
8. BA, Natural Science, Preparation for teaching (preparation for elementary school teaching)

Preparation for the Health Professions
9. Preparation for the Health Professions: Information for Undergraduates
10. Preparation for the Health Professions: Information for Second Baccalaureate / Post-Baccalaureate Students

Minors
11. Minor in Biological Sciences
12. Minor in Biological Sciences, Preparation for teaching
13. Minor in Science

The graduate programs of the Department of Biological Sciences include one MA in Biological Sciences degree, one MA in Clinical Life Sciences degree, three MS in Biological Sciences with concentration degrees, one MBT (Master of Biotechnology) degree, and curriculum for second baccalaureate pre-medical programs as listed below:

1. MA-Biological Sciences
2. MA Clinical Life Sciences (or Clinical Laboratory Scientists licensure program. The program has been accredited by the National Accreditation Agency for Clinical Laboratory Science since October 2004)
3. MS-Biological Sciences, Concentration in Organismal Biology, Conservation & Ecology
4. MS-Biological Sciences, Concentration in Physiology
5. MS-Biological Sciences, Molecular Biology & Microbiology
6. MBT (Master of Biotechnology) Program
7. Second Baccalaureate / Post-Baccalaureate Pre-Medical Studies

At the time of the self-study the department had:

a. 30 tenured tenure track full-time faculty and 3 regular part-time faculty members.
b. Average enrollment is approximately 550 undergraduate and 100 graduate students.
c. Student enrollment has steadily increased in the past 5 years. The highest undergraduate enrollment is 637 in Spring 2005 and the highest graduate enrollment is 125 in Fall 2002.
d. On the average, the acceptance rate for undergraduate program is about 55% and the enrollment rate (over the number of student accepted) is about 70%. Similarly, the acceptance rate for graduate program is about 50% and the enrollment rate is about 85%
e. On the average, the department graduates about 80 baccalaureates and about 28 masters per year.
f. Student enrollment is too low (below 3%) for undergraduate programs in Conservation and Organismal Biology and Natural Science. Similarly, student enrollment is too low (below 3%) for graduate programs in Physiology.

1.1 Assessment

The department has planned for a solid and comprehensive assessment program. Seven major outcomes have been identified for all students as listed below:

1. Mastery of the content of the core concepts of biological science.
2. Mastery of the content of required upper division courses in the academic program.
3. Mastery of fundamental biological laboratory/field skills.
5. Ability to work effectively in groups to solve scientific problems.
6. Competence in written communication of scientific information.
7. Proficiency in oral communication of scientific information.
   - Outcomes #4 through #7 will be assessed in the future. A plan for assessing these outcomes is in place.
   - Each of other learning objectives is accessed in almost every course through the use of assignments and exams.
   - All required courses are devoted to some of these learning objectives.
   - Educational Testing Service exams have been used to assess student improvement during the time at SJSU and to compare SJSU graduates to those from other universities.

A formal assessment procedure has been planned as summarized below:

- Assessment data will be consolidated, analyzed, and presented to the Chair and the department faculty members sometime at the end or the start of each year.
- Assessment data together with recommendations received from the departmental external advisory committee, graduate exit surveys, surveys of program alumni and employers will serve as a data set to suggest actions that the faculty or the department might want to take.
Formal curricular changes will be initiated, reviewed, and implemented.

1.2 Strength
a. Student enrollment has steadily increased in the past 5 years.
b. The continued strength in the biotechnology and healthcare industries over the last five years.
c. Staff members are solid and successfully provide support of the Department's instructional needs.
d. Faculty members are from excellent academic institutions in the U.S. with strong teaching and research records.
e. Most of laboratory courses are taught by tenured/tenure-track faculty members and the department has a strong commitment to excellence in teaching.

1.3 Issues / Challenges
a. The department must manage to optimize its program quality in order to accommodate the increasing number of students.
b. Due to the loss of full-time faculty by retirement, hiring new faculty to meet increasing enrollment is justified and replacing faculty teaching essential courses is a critical need. The department once had 50 full-time faculty for 2/3 the number of current students but now has only 30 full-time faculty and 3 regular part-time faculty members.
c. The department has a commitment to providing undergraduate students with a well-rounded biological education, with faculty members and courses in cell biology, molecular biology and genetics, anatomy and physiology, organismal biology, population biology, evolution & ecology. Though reductionist biology may currently offer more employment opportunities, systems biology, conservation biology, and evolutionary biology are clearly subdisciplines of critical importance for America in the 21st century.
d. Over the years the department has consolidated and reduced its concentrations to simplify the choices students need to make and to eliminate programs that suffered low student enrollments.
e. The department needs better funding to maintain and upgrade equipments, instrumentations, facilities and laboratories.
f. Keeping up the assessment plan and using assessment data to effectively adjust its programs.

1.4 Planning
a. In terms of assessment, the department has developed:
   o A plan to assess all its programs for laboratory and field skills, ability in information competency, team-work for problem solving, written and oral communication skills, in addition to other outcomes that have been assessed in the past.
   o A procedure to collect and store assessment data and analyze the data for possible curriculum improvement.
b. The department seems not to have a centralized planning process but each program developed its own (small) program planning without any future plan for the whole department. In general, most programs plan to maintain (or to improve) student enrollment at (from) current levels, to provide faculty members with opportunities to
work with industry experts or to improve external collaboration, and to continue to assess
student learning outcomes and adjust the program.

c. The department has projected critical faculty needs due to faculty retirement, increasing
in student enrollment, and the development of emergent areas. The department’s plan for
full-time faculty recruitment includes an anatomist, an immunologist, and a director of
biotechnology program. The idea of hiring faculty members who can teach courses in
more than one disciplinary area was also considered.

d. The department has initiated two funded programs to support faculty-student research:
The “Grant Development Reassigned Time” program and the “Travel Grant” program.

  o The “Grant Development Reassigned Time” program provides 0.2 released time for
  faculty members to write grant proposal for funding.

  o The “Travel Grant” program provides funding for faculty members to present their
  research at scientific meetings.

2. Summary of External Reviewer’s Comments and Recommendations (received on
September 06, 2006)

2.1 Reviewer’s Comments

  a. Staff members are solid and work well with faculty. Laboratories are well supported by
  strong staff and by direct faculty participation.

  b. Large number of concentrations that students can chose from in order to develop
  expertise in a selected area.

  c. Short-term planning for faculty hiring is in place but lack of a long-term plan. There are
  concerns about the health of the MS degrees in Physiology and Organismic &
  Conservation Biology (O&CB) since lack of a comprehensive departmental plan to deal
  with the recent retirements in these two areas.

  d. Resources for the department are steady, but inadequate to allow it to move beyond
  present level. There seems be no well articulated plan.

  e. The hiring of part-time faculty (PTF) and graduate student teaching associates (TA) is
  under utilized but this is partly due to the insufficient transfer of funds from the College
  in support of hiring of PTF.

  f. Faculty members become personally invested in a specialty course or concentration and
  so it is hard to deploy faculty to other courses.

  g. So many courses must be on the books to cover so many degree programs but the number
  of faculty is not growing, courses cannot be offered on a predictable two-year cycle.

  h. Space resources are minimally adequate with respect to square footage but are grossly
  inappropriately configured. Considerable renovation is required to support an expanded
  level of faculty-student research as the quality of research space varies dramatically
  among the faculty.

  i. Faculty must share office space, a condition that is not appropriate when confidential
  discussions with students are the norm for many faculty activities.

  j. There is considerable disagreement among faculty members of various ranks concerning
  the RTP process because there are no clearly written criteria.

  k. The assessment program plan is solid and comprehensive. However it does not include a
  mechanism for the programs to respond to assessment results.
1. The department offers thirteen undergraduate degree programs, several are excellent but some are suffering from lack of enrollment.

2. The MBT program is good. However, the intent to draw the program into the department and to convert the director to a tenure-track faculty member had failed to secure the services of the originating director. From the information that could be gathered, it appears that there were problems of politics and communication.

n. The planning report submitted for each degree program does not lend itself to the type of evaluation of future directions that the University seems to want. The department did not submit a coherent comprehensive plan for the department programs as a whole.

0. Report from each program was primarily focused on the portrayal and analysis of that program as it stands presently. There were minimal or no projections of plans for the future.

2.2 Reviewer's Recommendations

a. Recommend the university to better define the mechanism by which departments can generate a PPR that allows the reviewer to evaluate a long-term plan. This may only require that the Future Plans section specify the conditions required for the plan to meet expectations.

b. Recommend the PPR to be reviewed by the Dean to see that a departmental perspective and long-term plans are present such that an outside reviewer can reach the conclusions expected by the University.

c. Recommend the department to have an expert in assessment to analyze the plan and advise on how to retain the excellent intent while making it less labor intensive.

d. Recommend to increase communication among all department stakeholders (i.e., among faculty and between faculty and staff) and include faculty and staff in managerial decision-making.

e. Recommend to develop a comprehensive three- or five-year plan that looks at the department as a whole, including a revenue-generated-to-resource consumed comparison for the department overall.

f. Recommend to develop a comprehensive plan that considers long-term faculty turnover and hiring will be focused on specific objectives.

g. Recommend to create private offices for full-time faculty members.

h. Recommend to develop guidelines and criteria for new hiring, start-up funds, research space, teaching loads, etc...

i. Recommend to obtain RTP documents from biology departments throughout the CSU. Develop an RTP document that clearly identifies the threshold expectations for tenure and promotion. Improve mentoring system.

j. Recommend to define the department's resources allocated to BS Marine Biology due to its too low student enrollment. Argue why this program should not be transferred to CSU Monterrey Bay

k. Recommend for the development of a plan that allows the director of Masters in Biotechnology (MBT) program to succeed in running the program while meeting the department expectations for RTP. Reexamine the wisdom of moving the director into the department as an untenured faculty member under the conditions required for success of the program.
3. Summary of Department Response (February 20, 2007)

a. The department does not agree with the reviewer’s comment about the lacking of long-term faculty hiring plans from the department.

b. The department agrees to the reviewer’s comment that “the resources for the department are steady, but inadequate to allow it to move beyond its present level of activity.” The department however does not agree that “there is no well-articulated plan put forward” as stated by the reviewer, but believes that it does have a plan and has spent efforts on it.

c. The department does not agree with the reviewer’s comment about the department RTP process. The department argues that the vagueness of RTP expectations is from the University RTP document and administrative procedures, which are beyond the department level.

d. The department agrees that keeping up the assessment plan and using assessment data to adjust its programs will be a significant challenge for the department.

e. The department does not agree with the reviewer’s comment that “the MBT program is in turmoil and in danger of being destroyed.” The department believes that this perspective came from the director of the program who was leaving. The department believes that the interim director is currently managing the program well and it will search for a new program director starting in Fall 2008. The department believes that only one undergraduate program concentration in Conservation and Organism Biology is suffering from significant lack of enrollment, but argues that the enrollments should increase, and are currently growing, with the new degree in Natural Science with Concentration in Biodiversity.

4. Summary of College Committee Report (May 9, 2007)

The College of Science Curriculum Committee reviewed the Department of Biological Sciences Self Study (Fall 2005), the External Reviewer Report (received on September 06, 2006), and the response from Dr. Veregge (February 20, 2007) on behalf of the Department of Biological Sciences and its faculty.

a. The committee feels that the external reviewer has done a masterful job of getting to the essence of this very large and complex department.

b. The committee endorses the reviewer’s recommendations to the department about:
   - Increasing communication among all department stakeholders (i.e., among faculty and between faculty and staff) and include faculty and staff in managerial decision-making.
   - Developing a comprehensive three- or five-year plan that looks at the department as a whole, including a revenue-generated-to-resource consumed comparison for the department overall.

b. The committee recognizes the department efforts in generating the self-study but agrees with the external reviewer that the report does not read as a unified summary and plan for the future as well as lacking of common voice. The committee also notes that similar comments were made about the structure of the self-study for the 2000-01 program planning cycle.
d. The committee notices that the external reviewer examined the department from an administrator’s point of view and recognize that the department has a deserved reputation for excellent pedagogy, assessment, and strong student-faculty interactions.

e. The committee does not agree with the external reviewer for specific recommendation on discontinuing the BA Preparation for Teaching program. This is due to the fact that there are no resources consumed by this program.

f. The committee also notices that the BA Natural Science program was not included in the self-study report.

g. The committee comments about the department response as following: “Dr. Veregge’s departmental response should be read carefully. She convincingly counters some of Dr. Koch’s conclusions. In particular, she describes the long-range planning involved in hiring “bridge” faculty whose interests and abilities are multidisciplinary, and the creation of new degree programs to attract resources and FTES. These initiatives represent global/departmental issues paid too little attention in the current Self Study.”

h. The committee comments that the external reviewer’s recommendations to the university regarding guideline to generate PPR, the review of PPR by the Dean before present to outside reviewer, etc. are already in the Fall 2006 Revised SJSU Program Planning Guidelines.

5. Dean’s Report (May 9, 2007)

The Dean of College of Science reviewed the Department of Biological Sciences Self Study (Fall 2005), the External Reviewer Report (received on September 06, 2006), the response from Dr. Veregge (February 20, 2007) on behalf of the Department of Biological Sciences and its faculty, and the College of Science Curriculum Committee Report (May 9, 2007).

a. There is not much information in the Dean’s report but the confirmation of the complexity of the department and its crossroads in term of direction and focus. The Dean believes that department long range planning is an ongoing and thoughtful process.

b. The Dean endorses both the external reviewer’s document and the department response.

c. The Dean concurs with the college committee that new program planning protocols will benefit the next Biological Sciences self-study and other ongoing/pending departments.


The University Program Planning Committee reviewed the Department of Biological Sciences Self Study (Fall 2005), the External Reviewer Report (received on September 06, 2006) the response from Dr. Veregge (February 20, 2007) on behalf of the Department of Biological Sciences and its faculty, the College of Science Curriculum Committee Report (May 9, 2007), and the College of Science Dean Report (May 9, 2007). The committee commends the external reviewer for an excellent analysis and report.

The committee commends the department on excellent pedagogy, assessment, and strong student-faculty interactions. There are many admirable aspects of the program. However, each review body agreed that the missing element is medium to long range planning. A number of recommendations have been suggested for improving the programs. Some of those involve additional resources, but other recommendations could result in improved efficiency which
would help provide those resources. In spite of the fact that the Program Planning Report lacked sufficient evidence department-level planning, the Program Planning Committee recommends acceptance of the plan without modification.

The final step in the program planning process is a meeting with the Provost (or her designee), the Dean, and the Department Chair. Please contact Janette Pamintuan in the Office of Undergraduate Studies to schedule the final meeting. However, before scheduling the final meeting we recommend that the department faculty and Chair review the above suggestions and then have a discussion regarding the future direction of the department, perhaps with the College Dean.

The following agenda items are suggested for the meeting with the Provost or designee:
   a. Eliminating or combining concentrations and/or programs with very low enrollment, so as, at a minimum, to allow scheduling of each course offering at least every two years.
   b. Links between the assessment procedure, assessment results, analysis, the improvement process, and department strategic planning.
   c. Methods for improving communication among faculty members in different programs; and between faculty and staff.
   d. The possibility of developing Departmental RTP guidelines to supplement University guidelines. Improve mentoring of junior faculty.
   e. Where resources might be found to reconfigure research space.

If the Department would like to propose other issues, please let Janet Pamintuan know so that the items can be added to the agenda.

The next program review for all programs in the Department of Biology is scheduled for AY 2010-2011. The committee expects for the self-study in that cycle to include a comprehensive five-year plan that looks at the department as a whole, including a revenue-generated-to-resources-consumed comparison for the department overall.
May 9, 2007

MEMORANDUM

From: J. Michael Parrish, Dean

To: Thalia Anagnos, Director of Assessment and Professor of Engineering

RE: Department of Biology Self Study

I have read the program planning documents produced in 2005-2006 by the Department of Biological Sciences, the report from and their external reviewer, Dr. Robert Koch, the response to the external review by Dr. Sally Veregge, and Associate Dean Steve Branz’ assessment of the various program planning documents. As noted in all of these documents, the Department of Biological Sciences is complex, and somewhat at a crossroads in terms of direction and focus. It is an extremely inclusive department, and I know their long range planning is an ongoing and thoughtful process. I appreciate the comments made by both Drs. Koch and Veregge, and am happy to endorse these documents. I concur with Dr. Branz that the new program planning protocols will be beneficial to both the next Biological Sciences self-study and those of other departments that are ongoing and pending.
Department Response to Program Planning Report (PPR) Evaluation of the Department of Biological Sciences, San Jose State University

Prepared by Sally Veregge,
Past Chair, Department of Biological Sciences
20 February 2007 [date inserted by Stephen Branz]

Note that the reviewer's comments are in black and the Department Responses to the comments are in red and italicized.

Overview
I.A. Summary Evaluation
The Department projects the impression of a solidly functional group achieving the basic academic objectives required to offer a high-quality education. This assessment of the Department is accurate.

The Faculty is undergoing dramatic changes with several retirements and active recruitment going on. True. This process is being managed on a short-term basis by reacting to immediate needs, but suffers from the lack of a long-term plan. This is actually not true. The Department has spent a significant amount of time creating long-term hiring plans. The Department has identified its disciplinary strengths and needs and has targeted areas that it wants to enhance. It has looked at the needs of the region and of society in this process. The Department has also developed a philosophy of hiring "bridge faculty," faculty members who bridge more than one disciplinary area, to create both research and curricular collaborations and the collegiality that has allowed the faculty members to work as a team to achieve the Departmental mission (see mission statement on web page). The Department made a concerted effort to hire faculty members who are team players, service oriented, and high quality teachers and whose research matches the resources available and provides opportunities for our students. Much of the hiring strategy of the Department has been stifled by the recent dismal budgetary situation in the CSU.

The Staff are solid and successfully provide support of the Department's instructional needs. True. Recent hires have solidified the Staff composition and the group is prepared to continue effectively. True. Staff and Faculty work well together and appreciate the contributions of the other group. Very True. There are some issues of organizations that could improve the function of Staff overall. Some restructuring has occurred recently that will hopefully improve the staff organizational structure. Resources for the Department are steady, but inadequate to allow it to move beyond it present level of activity vis-à-vis increasing the faculty-student collaborative research activity—a goal that seems to be an undercurrent in many discussions, but not put forward in a well-articulated plan. Yes, this is true and the resources that come from the University get scarcer each year. There has been a plan, however. Over the last 8 years
there has been a very concerted effort to enhance the resources of the department in order to provide more time and dollars for faculty scholarly activity (and by definition in our department that includes student-faculty collaborative research). Those efforts included trying to become less reliant on revenues generated by General Education (GE) enrollments by creating more demand for our service courses and increasing our majors. About 10 years ago, departments outside of Biology suddenly were included in the Life Science GE Area, which resulted in a sudden loss to the Department of about 150 to 200 FTES. It was clear that because of the politics of GE, and the potential for sudden shifts in FTES, the department needed to diversify and develop other sources of FTES and revenues. As part of this endeavor, the Department initiated collaboration with the Chair of the Justice Studies Department and the Chair of Chemistry to develop a new Justice Studies major in Forensic Science. This major has significantly enhanced the enrollments in the Justice Studies Department and has brought additional FTES to Biology because a large number of units in this major are Biology courses. It also has increased enrollments in Chemistry classes because of the required Chemistry courses.

The Department also reinstated its Clinical Laboratory Science Training Program because of a growing demand for clinical laboratory scientists in the region and California. The Department gained extramural support for this program for 10 years. This means that every FTES generated by this program is paid for by external funding, which frees up resources to support time and dollars for faculty-student collaborative research, curriculum development and other creative activities. In addition, the initiation of this program has grown the FTES in prerequisite courses such as immunology and microbiology in the Biological Sciences Department and quantitative analysis in the Chemistry Department. The CLS program is of the highest quality, is now the largest or second largest in the State, and provides a wonderful service to our students who are hired the instant they graduate at starting salaries not less than $60,000 per year.

The Department also developed a self-support Master of Biotechnology program both to serve the needs of the region and to bring resources into the Department in terms of actual dollars, buyout dollars for faculty teaching in the program, and new equipment that could be used threefold (i.e., for teaching in the MBT Program, teaching in the General Fund Programs, and research). Some of the resources generated by this program have been used to match other departmental funds to purchase startup equipment for new faculty members, equipment that could also be used for MBT courses.

The Department also instituted a new major in Natural Science with a Concentration in Biodiversity to address the growing demand by students for a major that focuses on preserving species and the health of our Earth. The faculty worked very closely with colleagues at DeAnza College to articulate with their science-based environmental program. Preceding this program, through a Strategic Planning Retreat, the Department set as a goal the initiation of a
Biodiversity Center/Group to support education and research targeted at preserving biodiversity.

In addition to developing new sources of revenue, the Department has optimized class size and staffing to free up most faculty such that they have a 9-unit teaching load (i.e., to give them time for student-faculty research collaborations). In addition, the Department moved from giving all new faculty members 6 unit loads for one year to giving them 6 unit loads for three years, to allow them to get a good start on their scholarly activity. Further, the amount of money contributed directly by the department for startup funds for new faculty members has grown from $2500 (matched by the Dean) to up to $30,000 in good years. In addition, the Department has made a concerted effort to capture research space for new faculty within the current space limitations (noted by our Program Reviewer). We have invested in significant remodeling of space and repurposing. With that said, large spaces are shared, which is part of our department culture and a necessity brought on by lack of space and the poor design of Duncan Hall. The Department has been active in the College of Science in working with the Chancellor's Office to try to acquire a new building and the remodeling of Duncan Hall and in trying to persuade the Chancellor's Office that if faculty members are expected to do research, they need research space. The Department was also the prime mover, with much effort and persuasion directed at F, D, and O, in getting a backup generator for Duncan Hall, which has and still does suffer power outages that in that past have resulted in the loss of months if not years of faculty research products.

As another example of planning to support faculty-student research, the Department, through its Strategic Planning Retreat, initiated two intramurally funded programs to support scholarship: 1) The Grant Development Reassigned Time Program whereby faculty members compete for 0.2 reassigned time to be used to write a grant proposal for extramural funds, and 2) The Travel Grant Program whereby faculty members compete for travel funds to present their research at scientific meetings. Each of these programs requires that competing faculty members present their proposals or research to the department to enhance the exchange of ideas and possibilities for collaboration.

The hiring of part-time faculty (PTF) and use of graduate student teaching associates (TA) is under utilized, but this is partly due to the insufficient transfer of funds from the College in support of the hiring of PTF. Yes, the resources that come to the Department seem to decrease every year. The Department used to receive $1150 per FTES generated for every FTES gained over the base FTES expectation (called secondary FTES) and about $30,000 of equipment money every year. (Note: The base FTES is determined by the multiplying the SFR times the tenured/tenure track FTEF.) The Department lost its equipment budget about 5 years ago and last year the department received only about $770 per secondary FTES. This year the Department’s SFR was raised from 19.5 to 22 and the amount that the Department receives per secondary FTES has once again
decreased. This is a double hit because increasing the SFR automatically decreases the potential for secondary FTES and the associated funding.

Space resources are minimally adequate with respect to square footage but are grossly inappropriately configured—considerable renovation is required to support an expanded level of faculty-student research as the quality of research space varies dramatically among the faculty. In addition, faculty must share office space, a condition that is not appropriate when confidential discussions with students are the norm for many faculty activities. Yes. We would love to have the resources to do substantial remodeling or to have support from the Chancellor’s Office to renovate Duncan Hall. We have done as much remodeling as our budget has allowed and sometimes more.

There is considerable disagreement among faculty members of various ranks concerning the RTP process because there is no clearly written set of criteria. The effect of this ambiguity on assistant professors is exacerbated by the Department’s inability to complete promised lab renovations in a timely manner—this impacts the correlation between the expected productivity and practical capacity to produce using the resources available. Part, if not all, of the vagueness of RTP expectations derive from the University RTP document and administrative procedures and vagueness beyond the level of the Department (at the College-level, Dean’s level, and above). As the past Department Chair, I was very much hampered by the lack of clarity from above about the RTP expectations, and the changing playing field with changing leadership. At the College-level, there has been ambiguity, with the expectations of the College-level committee often changing depending who was on the Committee. With that said, a group of faculty members in the Department are working to develop more detailed departmental RTP guidelines. The origin of issues with ambiguity, however, have not been at the departmental level. Departmental guidelines and even expectations outlined in appointment letters have been ignored at higher levels. This is an issue that needs to also be addressed at the College-level and above.

The comments about not completing promised lab remodeling in time are a bit exaggerated. The only remodeling that was promised to a new faculty member was promised to our newest hire and the expectations for when that remodeling would be completed were very clearly laid out in addition to the option of moving into a lab that required no remodeling. One faculty member who recently was tenured did have spare equipment stored in that faculty member’s lab, which took too long to be removed. That faculty member also had to invest time in “cleaning up” that lab, which was a common use room prior to being designated as a research lab. Faculty members hired subsequently were provided with labs that were in essence ready to go. Most of the labs, however, are not ideally configured because of the design of Duncan Hall.

The Assessment Program plan is solid and comprehensive, and, if not so ambitious that it becomes bogged down by the weight of its own demands, will
provide considerable data on the progress and achievements of the students; however, it does not include a mechanism for degree programs to respond to the results of the assessment program. Yes, the assessment program is ambitious, possibly too ambitious, and yes the loop needs to be closed. With that said, our Department seems to be in sync with or somewhat ahead of the rest of the University regarding assessment. Keeping up this ambitious effort and using the data gathered to adjust our programs is going to be a significant challenge for the Department.

The Department offers thirteen degree programs—several are excellent and some are suffering from lack of enrollment. One program, the MBT, is in turmoil and in danger of being destroyed. Only one of the undergraduate degree programs, the Concentration in Conservation and Organismal Biology, is suffering from significant lack of enrollment. The enrollments in that program should increase with the new degree in Natural Science with a Concentration in Biodiversity. Also, the faculty members in that program have made Herculean efforts to streamline the program over the past few years. The enrollments in that program are currently growing.

The suggestion that the MBT program is in turmoil and in danger of begin destroyed is a bit of an overstatement. This perspective came from the Director of the Program, who was leaving. The program itself and the curriculum are as strong as they ever were. The enrollments in the program decreased with the entering class of 2006 because of circumstances related to the Director’s departure. Interest in the program is high, and in Fall 2007, we hope to admit the largest class since the program was initiated. An interim director is currently managing the program. We will be searching for a new program director to start in Fall 2008.

The materials submitted in support of each degree program did not lend itself to the type of evaluation of future directions that the University seems to want and the Department did not submit a coherent, comprehensive plan for the department programs as a whole. Yes, this current Program Plan was not as focused as our last Program Plan and was lacking in overt statements about future plans for the Department as a whole. It could have been a stronger document. Our department tends to be a continuously planning department that responds to the changes and opportunities of our rapidly changing environment.
Program Planning Report (PPR) Evaluation
of the
Department of Biological Science
San Jose State University
Submitted by
Dr. Robert A. Koch, Chair,
Department of Biological Science,
Cal State Fullerton

Overview

I.A. Summary Evaluation

The Department projects the impression of a solidly functional group achieving the basic academic objectives required to offer a high-quality education. The Faculty is undergoing dramatic changes with several retirements and active recruitment going on. This process is being managed on a short-term basis by reacting to immediate needs, but suffers from the lack of a long-term plan. The Staff are solid and successfully provide support of the Department’s instructional needs. Recent hires have solidified the Staff composition and the group is prepared to continue effectively. Staff and Faculty work well together and appreciate the contributions of the other group. There are some issues of organizations that could improve the function of Staff overall. Resources for the Department are steady, but inadequate to allow it to move beyond its present level of activity vis-à-vis increasing the faculty-student collaborative research activity—a goal that seems to be an undercurrent in many discussions, but not put forward in a well-articulated plan. The hiring of part-time faculty (PTF) and use of graduate student teaching associates (TA) is under utilized, but this is partly due to the insufficient transfer of funds from the College in support of the hiring of PTF. Space resources are minimally adequate with respect to square footage but are grossly inappropriately configured—considerable renovation is required to support an expanded level of faculty-student research as the quality of research space varies dramatically among the faculty. In addition, faculty must share office space, a condition that is not appropriate when confidential discussions with students are the norm for many faculty activities. There is considerable disagreement among faculty members of various ranks concerning the RTP process because there is no clearly written set of criteria. The effect of this ambiguity on assistant professors is exacerbated by the Department’s inability to complete promised lab renovations in a timely manner—this impacts the correlation between the expected productivity and practical capacity to produce using the resources available. The Assessment Program plan is solid and comprehensive, and, if not so ambitious that it becomes bogged down by the weight of its own demands, will provide considerable data on the progress and achievements of the students; however, it does not include a mechanism for degree programs to respond to the results of the assessment program. The Department offers thirteen degree programs—several are excellent and some are suffering from lack of enrollment. One program, the MBT, is in turmoil and in danger of being destroyed. The materials submitted in support of each degree program did not lend itself to the type of evaluation of future directions that the University seems to want and the Department did not submit a coherent, comprehensive plan for the department programs as a whole.
I.B. The PPR and the Expectations of the University

The PPR discussed thirteen different degree programs. Each program report was primarily focused on the portrayal and analysis of that program as it stands presently. There were minimal or no projections of plans for the next five years. It is recommended that College and Academic Program administrators ensure that the program performance reports include specific plans for the future if that is to be a primary focus of the program evaluator’s report. Using a process similar to the standard analysis of strengths, weaknesses, opportunities, and threats with the requirement that plans for the future incorporate responses to that analysis might reach the goals of the University more appropriately.

The external evaluator needs insight into the budgetary considerations of the department as a whole. What are sources of revenue? How are resources allocated? How are shortfalls or unexpected demands met? How are decisions of long-term costs justified? What options does the Department have for solving budget and personnel management issues? A cost-benefit analysis that considers resources generated by specific degree program compared to the cost of that program with respect to faculty time and other costs per students educated would be useful. A significant short-coming of this PPR was the lack of a Department overview to each program proposal—it seemed that each section was prepared by the faculty in that program without consideration for the allocation of resources as a whole.

Recommendations:
Department.

1. Increase communication among all department stakeholders (i.e., among faculty and between faculty and staff) and include faculty and staff in managerial decision-making.

2. Develop a comprehensive three- or five-year plan that looks at the Department as a whole, including a revenue-generated-to-resource consumed comparison for the Department overall.

University.

1. More clearly define the mechanism by which departments can generate a PPR that allows the reviewer to evaluate a long-term plan—this may only require that the Future Plans section specify the conditions required for the plan to meet expectations.

2. Establish a mechanism to ensure that a department-wide perspective is included in the PPR.

3. Require a cursory review of the PPR by the Dean to see that a departmental perspective and long-term plans are present such that an outside reviewer can reach the conclusions expected by the University.

II. Evaluation of the Biology Undergraduate Curriculum and its Degree Programs.

II.A. Overview of Undergraduate Curriculum

Overall the undergraduate curriculum has two major strengths: (1) a high number of high-quality laboratory hours well supported by a strong staff and by direct faculty participation; and (2) the large number of concentrations that students can choose from in order to develop expertise in a selected area.
There are three major weaknesses: (1) it strains resources to have instructors for the large number of courses that are required to keep thirteen degree programs afloat simultaneously; (2) faculty become personally invested in a specialty course or concentration and, when student enrollment wanes (as it has in some), it is hard to deploy faculty to other courses; and (3) because so many courses must be on the books to cover so many degree programs and the number of faculty is not growing, courses cannot be offered on a predictable two-year cycle.

II.B. BA Biological Science

This program appeals to students not interested in developing an area of expertise in one of the Concentrations and serves 30% of all majors. More breadth and integration of information is required than in BS programs and less lab work is required. This program meets a current need and is consistent with the University Statement of Curricular Priorities. The Department has not collected feedback from its graduates or their employers concerning the success of this program, but has vague plans to do so. The Department Assessment Plan was most well articulated in this section of the PPR materials and will be discussed in a later section of this evaluation.

Recommendation: Retain the BA in Biological Science.

II.C. BS Conservation and Organismal Biology

This program serves a small percentage of the students (7%), but is the primary choice for many students in the teacher credential program. However, there is no a plan to use this preference to build program strength. The faculty members involved in this program have agreed to shoulder responsibility for the large section general biology courses and have contributed to the Department success by taking on this role. That helps the Department, but does not address the issue of how to strengthen this subset of the Department. Overall, the Department is committed to keeping this program active, but coherent, long-term plan needs to be developed to insure the long-term health of both the Concentration and Department.

The program suffers from several recent retirements. The PPR proposes replacing these faculty members, but this seems to be a focus of those in the program and is not widely addressed in a Department long-term hiring plan. Short-term hires are under way in area—this apparently is due to a commitment by the Department to maintain this area—but the process in place does not define how resources will be allocated to maintain a full load for these new hires. Thus, at best, this short-term response poses a tough challenge for the Department and, at worst, a threat to department resources. (How will resource allocations be determined? What are the long-term hiring strategies to be employed?)

Discussion items included in this section concerning the future did not thoroughly address predicted student demand, nor ways to make up for present enrollment shortfalls. Ideas that had the appearance of plans were more like speculations and hopes. An appraisal of the problems created for the entire department (not just the degree program) by the low performance of this program is needed. The liability that this program poses to the Department must be mitigated by a plan that defines its contributions and the long-term commitment of department resources to supporting the program is needed. (Can the program decrease the number of faculty required to offer the degree, and therefore the consumption of department resources, in a fashion that balances the ratio of revenues
MA - Biological Sciences

MA - Biological Sciences
Course Requirements
Graduate Courses in Biology 5-7
BIOL 201, BIOL 202 and BIOL 284
Additional Graduate Course 1-4
Any approved 255 course (any department prefix or suffix)
Electives 19-24
100- or 200-level courses chosen with advisor consent
Total Units: 30

A. Centrality to mission
Goals of the Program
The goal of the M.A. in Biological Sciences is to prepare graduates for employment in their chosen field at an advanced level or for doctoral-level training or professional schools, and to provide them with a rigorous academic environment in which they can develop the observational, technical, and deductive reasoning skills required for a successful career in the biological sciences without the various costs and benefits of pursuing an individual research project. The specific program goals are to provide advanced academic instruction; to offer the degree option of course work (non-thesis) with curricular flexibility to best meet the needs of the student and societal needs for graduate-level training; to teach effective communication of scientific ideas; offer core masters-level courses along with a selection of elective courses which allow graduate students to learn fundamental concepts in their chosen discipline while gaining experience in related and complementary fields; and to provide students and faculty with adequate teaching space, supplies, and equipment in order to foster an environment conducive to effective teaching, learning, and scholarship in the biological sciences.

Program Contributions to the Mission of SJSU
The M.A. Biological Sciences provides students with advanced intellectual and practical skills required for successful careers in the three major academic areas of the department: Molecular Biology and Microbiology (M&M), Anatomy and Physiology (A&P), and Organismal and Evolutionary Biology (O&E) and their various subdisciplines, and gives them a broad-based understanding of how these disciplines, and science in general, can be applied to meet societal needs.

B. Quality of instructional program
Students in the M.A. Biological Sciences take 20% more course units than those in the M.S. Biological Sciences program (because six units are usually devoted to research activities and thesis writing for the latter population of graduate students). This instruction is provided by regular faculty from each of the academic discipline areas of the department. The department strives to provide an array of lecture, laboratory and seminars at the graduate level, and many students in the M.A. program take courses outside their primary area. These students are more broadly trained in the various areas of
biology than students in the M.S. Biological Sciences program who are trained in greater depth in more narrowly focused programs of study. M.A. students usually determine their area of study based on their interests and vocational objective and chose their specific courses with the help of their discipline-specific graduate advisor and two other graduate committee members.

The number of students currently (Fall 2005) active in the department indicates that the distribution among academic discipline areas is disproportional with Molecular Biology and Microbiology (M&M), and Clinical Laboratory Sciences having the highest numbers, and the Organismal and Evolutionary Biology (O&E) area having none. The low number of O&E M.A. students can be attributed to the O&E faculty actively discouraging non-thesis-based master’s degrees for its students and the low interest on the part of prospective O&E masters students in the M.A. option.
Percent of enrolled M.A. Biological Sciences graduate students in Fall 2005 for each academic discipline area (Anatomy & Physiology, Molecular Biology & Microbiology and Organismal and Evolutionary Biology) and Clinical Laboratory Sciences.

One of the strengths of our graduate program is the cadre of our faculty who participate in interdisciplinary curricula. For example, Bio 218 (Evolution) has been team-taught by faculty members from both the M&M and O&E area faculty. This approach brings together students and faculty from both disciplines who would otherwise never take or teach classes together. Another strength is the depth and currency of our graduate laboratory offerings. Biology 227 (Physiology and Pharmacology) is the only course of its kind in the region and is intensely sought after by our students.

Biological Sciences Department Graduate Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 201</td>
<td>Graduate Seminar in Biological Sciences</td>
</tr>
<tr>
<td>BIOL 202</td>
<td>Graduate Studies in Biology</td>
</tr>
<tr>
<td>BIOL 205</td>
<td>Advanced Molecular Techniques</td>
</tr>
<tr>
<td>BIOL 210</td>
<td>Molecular Mechanisms of Cellular Activation</td>
</tr>
<tr>
<td>BIOL 215</td>
<td>Seminar in Advanced Genetics</td>
</tr>
<tr>
<td>BIOL 218</td>
<td>Evolution</td>
</tr>
<tr>
<td>BIOL 221</td>
<td>Bioinformatics</td>
</tr>
<tr>
<td>BIOL 223</td>
<td>Radiation Biology</td>
</tr>
<tr>
<td>BIOL 227</td>
<td>Advanced Physiology/Pharmacology Laboratory</td>
</tr>
<tr>
<td>BIOL 230</td>
<td>Comparative Animal Physiology</td>
</tr>
<tr>
<td>BIOL 233</td>
<td>Immunological Techniques</td>
</tr>
<tr>
<td>BIOL 234</td>
<td>Cellular Ultrastructure</td>
</tr>
<tr>
<td>BIOL 240</td>
<td>Scanning Electron Microscopy in Biology</td>
</tr>
<tr>
<td>BIOL 255</td>
<td>Seminar in Advanced Biology</td>
</tr>
<tr>
<td>BIOL 255E</td>
<td>Seminar in Advanced Biology: Organismal Biology</td>
</tr>
<tr>
<td>BIOL 255L</td>
<td>Advanced Bioby Laboratory</td>
</tr>
<tr>
<td>BIOL 255M</td>
<td>Seminar in Advanced Biology: Molecular and Microbiology</td>
</tr>
<tr>
<td>BIOL 255P</td>
<td>Seminar in Advanced Biology: Physiology</td>
</tr>
<tr>
<td>BOT 255</td>
<td>Advanced Botany</td>
</tr>
<tr>
<td>ENT 255</td>
<td>Advanced Entomology</td>
</tr>
<tr>
<td>MICR 250</td>
<td>Topics in Advanced Microbiology</td>
</tr>
<tr>
<td>MICR 270</td>
<td>Advanced Virolology</td>
</tr>
<tr>
<td>MICR 291</td>
<td>Field Work in Clinical Laboratory Science</td>
</tr>
<tr>
<td>MICR 292</td>
<td>Topics and Demonstrations in Clinical Laboratory Science</td>
</tr>
</tbody>
</table>
Physiology graduate students. Furthermore, all of the graduate laboratory courses in each concentration are taught by faculty with research expertise in the field. Recent acquisition of state-of-the-art instrumentation (DNA sequencer, digitizing fluorescent microscope, scanning spectrophotometers, flow cytometers, etc.) will enable our students to develop laboratory skills through classroom laboratory instruction usually reserved for research students at major research institutions. On the other hand, many non-molecularly oriented courses (such as Bio 234 (Cell Ultrastructure) are limited by problems with old and broken equipment and lack of service contracts. While the department has been the beneficiary of a campus decision to enhance the molecular biology and biochemistry programs, overall department funds for equipment maintenance and upgrades have declined over the last ten years to the detriment of all the non-molecular undergraduate and graduate programs.

As a way of further improving the graduate curriculum, each of the three academic discipline areas offers a graduate course each semester as an Advanced Biology Seminar (Bio 255). These special topic seminars (e.g., Gene Therapy, Conservation in the 21st Century, Space Biology, Physiology of Vision, Pathophysiology, Flow Cytometry Analysis, Protein Expression, and Advances in Immunotherapy) have greatly enhanced the curriculum. Additionally, students enrolled in the Clinical Laboratory Sciences program at SJSU are concurrently enrolled as M.A. Biological Sciences students and take Microbiology 291 and 292 (Fieldwork in Clinical Laboratory Science and Topics; Demonstrations in Clinical Laboratory Science) designed specifically for them.

Graduates of the M.A. Biological Sciences program have been successful in the job market and in gaining entry to medical, graduate, and other professional schools. It is interesting that these Biological Sciences graduates (course work only) seem to be as successful in gaining employment as the M.S. students who have the added experience of a research project. We attribute this to the intensive hands-on training that all of our master’s students receive. Molecular Biology and Microbiology students have extensive laboratory experiences. Anatomy and Physiology students receive a significant amount of small animal-handling experience that sets them apart from graduates of other institutions. Organismal and Evolutionary Biology students spend hours in the field honing their observational and data-collecting skills. In general, practical training at SJSU means less on-the-job training is required when the students are hired.

Ultimately, the best indicator of program quality may be the ability of our graduates to compete in the job market and go on to fulfilling careers in their chosen discipline or to gain entry into professional schools. Anecdotally, by these indicators our graduate program has been remarkably successful. Overall, the M.A. Biological Sciences program is in good shape. Nearly all of the graduates of the three academic disciplines have gone on to careers in their areas. The addition of several new faculty over the past five years has modernized the curriculum. Limitations in tenure-track faculty (more retirements than new hires, even as programs increase in size and number), instructional resources, and the loss of laboratory space to other departments are the main issues on the horizon that may have a negative impact on program quality. As mentioned before, the acquisition of new equipment has been lagging behind the program’s needs for a decade, and that equipment obtained has seldom been provided with a sufficient maintenance budget to keep it in service as long as it could be.
C. Student demand
The total number of students enrolling in the M.A. Biological Sciences program has remained relatively stable for the last five years. Two years ago we instituted a more rigorous selection process to include the subject and written GRE, written narratives, and interviews for students based in the M&M, and A&P discipline areas. Although the number of applicants has remained high, the percentage accepted from the pool of applicants has been smaller than in previous years. These data include both the student applications, acceptances, and enrollments for those seeking an M.A. Biological Sciences and the Clinical Laboratory Sciences program (see CLS program plan). When these two populations are compared, it is clear that most of the applicants, and 37% of the students enrolled in the last two years, were not seeking a degree in M.A. Biological Sciences, but rather Clinical Laboratory Sciences training and licensure.

![Graph](image)

Number of students applying to, accepted by and enrolled in the M.A. Biological Sciences program (2000-2005).
D. Societal need
The need for entry-level molecular biologists, microbiologists, and physiologists has held steady over the past several years due to the growth of the biotechnology industry and health care industry in the Bay Area. Our location in the Bay Area, which has one of the highest concentrations of these kinds of companies in the world, requires graduates from our program. Students with expertise in ecology will continue to be employed by government agencies (Water Districts, Fish and Game, etc.) and environmental consulting firms. Finally, our M.A. program provides the foundation that many of its graduates require to continue on to advanced training in doctoral and professional schools, thereby adding to the numbers of scientific leaders and health care professionals our society needs to remain on the cutting edge of science and medicine.

While there the biotechnology industry goes through expansions and contractions like other industries, the employment opportunities for program graduates are similar to what they were five years ago and might be expected to remain the same in the years ahead. Research experience will always provide an edge to those students who have it, we plan to actively encourage students to seek out outside internships as well as on-campus assistantships to address this reality.

Given the increasing focus on developing antibody-based therapeutics and cell-based (including stem-cell-based) therapies, it is possible that the local demand for students trained in the production or manipulation of antibodies and culturing of cells will increase in the next five years. We will match this need by providing state-of-the-art laboratory courses in these areas.
E. Financial resources, viability, and efficiency
Nearly all of the funding for instructional materials in the graduate program is provided by the department. The department’s equipment budget is far too low, so high-end laboratory instrumentation must come from other sources (College of Science, Lottery funds, outside grants, donation, and self-support programs such as the Masters of Biotechnology, MBT, program). One major concern that has been precipitated by acquiring new equipment is the high-cost of service contracts. While much of our new equipment can be serviced by our own technicians, the cost of service contracts for that which cannot be can run as high as $5000 per year per item.

The department decided almost ten years ago to allow the graduate program to grow to a point where a larger variety of graduate courses could be given. This shift has allowed the program to grow without a commensurate increase in the resources needed by the program. The program is also limited by faculty time and energy (both in teaching the graduate courses and in serving as advisors), and by instructional resources. Only a limited number of faculty (currently eight of 30) accept and support M.A. students and serve on their graduate committees. Given impending retirements of up to three faculty teaching in the M.A. program, it will be essential for new faculty to be recruited who can both teach essential program courses as well as their unique research interests.

F. Interdependence of programs
M.A. students comprise about 10% of the total biology student population. These students populate our graduate and upper division courses and serve as graduate assistants in our courses. They contribute in a positive way to the department graduate and undergraduate programs. Low enrolled courses, often cancelled in previous years, can be offered because of the increased enrollment by students in the M.A. program. M.A. students often serve as graduate assistants in our laboratory courses that would otherwise be staffed by tenure-track faculty.

G. Capacity to contribute to an academic field
Faculty teaching in the M.A. program have active research programs, have presented at numerous scientific meetings, and have published widely (see department faculty data). While providing a robust M.A. program (non-thesis) does not contribute to department scholarship, it doesn’t significantly interfere with it either.

H. Availability of instructional alternatives
Other Bay Area universities (UCSC, UC-Berkeley, UCSF, Stanford, SFSU, and CSU East Bay) offer graduate training in the biological sciences. Only SFSU, and CSU East Bay offer a master’s as their terminal graduate degree, and neither offer an M.A. Biological Sciences. San Jose State University is unique in the region in this respect. All of our graduate programs suffer due to limited tenure track faculty and instructional resources and the heavy faculty work loads. We have lost considerable FTES in our General Education program over the past 10 years as GE criteria were changed and easier course offerings in other departments were approved. Student-faculty ratios have increased as the number of students has increased and the number of tenure-track faculty has decreased. The department continues to work at the balancing act between large classes and a diversity of classes needed to support our diverse graduate program.
Goals for the next five years

1. Establish teaching assistant and internship opportunities for M.A. students as resources become available
2. Further refine our admissions process to tailor graduate acceptances to match the course offerings and teaching needs of the department
3. Maintain and enhance existing graduate courses to keep them current; develop a mammalian cell culture course that involves some stem cell experimentation
4. Design a prescribed, two-year ‘advisorless’ curriculum for M.A. students so that students graduate more expeditiously
5. Establish an expedient, meaningful culminating experience: a project-based course, internship or teaching associate experience.
6. Develop an assessment plan to measure the effectiveness of the M.A. program at providing its students with the knowledge and skills that we want them to acquire
7. Recruit an immunologist (to teach immunology and advanced immunological techniques courses) and a second bioinformaticist / cell biologist (to help teach bioinformatics and advanced molecular techniques courses), as well as other faculty to replace M.A. program faculty who plan to retire in the next five years: (Brinegar [Advanced molecular techniques; Bio 205], Fowler [Advanced seminar in genetics; Bio 215], and Rodriquez [Graduate studies in biology; Bio 202]).
Clinical Laboratory Scientist Training Program

Program Requirements:

The Clinical Laboratory Scientist training program is 52 weeks long, completed after students finish their bachelor's degree in a science major. Prior to entering the program, all CLS students also have completed state required prerequisite coursework which prepares them for advanced study and clinical practice. Students participate in clinical rotations 4 days a week, 8 hours per day and have lectures on advanced topics in Clinical Chemistry, Hematology, Medical Microbiology and Transfusion Service 8 hours per week. Lectures include case studies that encourage students to apply their knowledge to clinical scenarios.

The structure of this program is constrained by state law and national certification agencies. The curriculum and internship complies with California state requirements for training schools and has been licensed since 2002. We have also been accredited by the National Accreditation Agency for Clinical Laboratory Science since October 2004. All of our graduates have been eligible to take national certification exams (ASCP).

A) Centrality to mission:

Mission and goals of the program:
The mission of the CLS training program is to prepare students for California state licensure and national certification as Clinical Laboratory Scientists. The program is structured such that graduates will qualify for and pass those exams. CLSs are the only individuals approved by the state of California to perform most diagnostic testing and are an essential part of the healthcare team. CLSs earn a competitive wage and can take pride in the contribution they make to patient care.

Program Contributions to the Mission of SJSU.
Graduation from the CLS training program allows students to use the knowledge they have acquired in their science major in service to others in the community. The CLS license allows training program graduates to perform work in clinical areas and gives them special skills and advanced training in cutting edge laboratory techniques. They are competitive applicants for pharmaceutical and biotech research positions. Most students enrolled in the program experience an increase in their earning potential after licensure and have a larger number of careers available to them than they would with a science degree alone.

B) Quality of the instructional program

Completion of the program requires that students complete three semesters of Microbiology 292, a lecture course which covers advanced topics in Clinical Chemistry, Hematology, Medical Microbiology and Transfusion Service. The students also take three semesters of Microbiology 291 which gives them credit for the training they receive at their clinical affiliate. We know that we are training our students effectively because they are consistently passing their state licensure and national certifying exams and are being hired by local employers.
Assessment:
The California State Licensure Exam in Clinical Laboratory Science is the most important exam our students take. Licensure is required before the students can practice in a clinical setting – if they complete the training program but do not pass the licensure exam, they will not be able to perform the work they have been trained to do.

State Exam Performance:
All eleven students who have taken the state exam have passed it and are working in California clinical labs. Performance data is available for five of the eleven students (this information was volunteered by those students – the program director cannot access this information without express permission from the students). The content of the exam matches the content of our lecture series, including Clinical Chemistry (including urinalysis), Hematology, Medical Microbiology (including bacteriology, parasitology, virology, mycology, immunology and serology), Transfusion Service (immunohematology). Some additional topics covered by that exam include Quality Assurance, California State Law, Phlebotomy, Lab Safety and Specimen Collection. These are incorporated in various parts of the lecture series as part of the discussion of clinical practice. Performance by content section is listed in Table 1. Students are required to achieve a 60% or better on the exam to pass. Scores achieved range from 72.5%-87.5%, well above the required level for passing.

Table 2 summarizes the average score in each subject area. The performance in different areas is roughly equivalent with scores as follows: Clinical Chemistry (82%), Hematology (77%), Medical Microbiology (85%), Transfusion Service (77%) and Other (83%).

Table 1: Student performance on the California State Licensure exam, total scores and scores by subject area

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Total possible</th>
<th>Student A</th>
<th>Student B</th>
<th>Student C</th>
<th>Student D</th>
<th>Student E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw score</td>
<td>percent</td>
<td>Raw score</td>
<td>percent</td>
<td>Raw score</td>
<td>Raw score</td>
</tr>
<tr>
<td>Bacteriology</td>
<td>27</td>
<td>24</td>
<td>89%</td>
<td>23</td>
<td>85%</td>
<td>22</td>
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<tr>
<td>Mycology</td>
<td>6</td>
<td>5</td>
<td>83%</td>
<td>5</td>
<td>83%</td>
<td>5</td>
</tr>
<tr>
<td>Virology</td>
<td>4</td>
<td>3</td>
<td>75%</td>
<td>4</td>
<td>100%</td>
<td>4</td>
</tr>
<tr>
<td>Parasitology</td>
<td>6</td>
<td>6</td>
<td>100%</td>
<td>6</td>
<td>100%</td>
<td>6</td>
</tr>
<tr>
<td>Serology/Immunology</td>
<td>20</td>
<td>14</td>
<td>70%</td>
<td>14</td>
<td>70%</td>
<td>16</td>
</tr>
<tr>
<td>Immunohematology</td>
<td>25</td>
<td>22</td>
<td>88%</td>
<td>23</td>
<td>92%</td>
<td>13</td>
</tr>
<tr>
<td>Clinical Chemistry</td>
<td>45</td>
<td>33</td>
<td>73%</td>
<td>42</td>
<td>93%</td>
<td>32</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>13</td>
<td>12</td>
<td>92%</td>
<td>12</td>
<td>92%</td>
<td>8</td>
</tr>
<tr>
<td>Hematology</td>
<td>38</td>
<td>28</td>
<td>74%</td>
<td>33</td>
<td>87%</td>
<td>29</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>5</td>
<td>5</td>
<td>100%</td>
<td>4</td>
<td>80%</td>
<td>2</td>
</tr>
<tr>
<td>Laws</td>
<td>5</td>
<td>5</td>
<td>100%</td>
<td>4</td>
<td>80%</td>
<td>4</td>
</tr>
<tr>
<td>Safety/Specimen Collection/Phlebotomy</td>
<td>6</td>
<td>4</td>
<td>67%</td>
<td>5</td>
<td>83%</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Scores / Percents: 200 / 80.5%, 175 / 87.5%, 145 / 72.5%, 154 / 77.0%, 167 / 83.5%
Table 2: Average student performance by subject area

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Total possible</th>
<th>Average score</th>
<th>Average Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Chemistry (Total)</td>
<td>58</td>
<td>47.6</td>
<td>82%</td>
</tr>
<tr>
<td>Clinical Chemistry</td>
<td>45</td>
<td>36.4</td>
<td>81%</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>13</td>
<td>11.2</td>
<td>66%</td>
</tr>
<tr>
<td>Hematology (Total)</td>
<td>38</td>
<td>29.2</td>
<td>77%</td>
</tr>
<tr>
<td>Hematology</td>
<td>38</td>
<td>29.2</td>
<td>77%</td>
</tr>
<tr>
<td>Medical Microbiology (Total)</td>
<td>63</td>
<td>36.4</td>
<td>85%</td>
</tr>
<tr>
<td>Bacteriology</td>
<td>27</td>
<td>22</td>
<td>81%</td>
</tr>
<tr>
<td>Mycology</td>
<td>6</td>
<td>4.8</td>
<td>80%</td>
</tr>
<tr>
<td>Parasitology</td>
<td>6</td>
<td>6</td>
<td>100%</td>
</tr>
<tr>
<td>Serology / Immunology</td>
<td>20</td>
<td>14.8</td>
<td>74%</td>
</tr>
<tr>
<td>Virology</td>
<td>4</td>
<td>3.6</td>
<td>90%</td>
</tr>
<tr>
<td>Transfusion Service (Total)</td>
<td>25</td>
<td>19.2</td>
<td>77%</td>
</tr>
<tr>
<td>Immunohematology</td>
<td>25</td>
<td>19.2</td>
<td>77%</td>
</tr>
<tr>
<td>Other (Total)</td>
<td>16</td>
<td>13.2</td>
<td>83%</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>5</td>
<td>3.8</td>
<td>76%</td>
</tr>
<tr>
<td>California State Law</td>
<td>5</td>
<td>4.4</td>
<td>88%</td>
</tr>
<tr>
<td>Safety / Specimen Collection / Phlebotomy</td>
<td>6</td>
<td>5</td>
<td>83%</td>
</tr>
</tbody>
</table>

National Certification Exams: American Society for Clinical Pathology (ASCP)

ASCP is the national standard for excellence in the clinical laboratory. In states where licensure is not required, most hospitals do require ASCP certification for all CLSs or pay a premium to those who are certified. For this reason, all students are encouraged to take the ASCP exam and most elect to do so.

Of our 24 graduates, 19 have taken the ASCP exam. This test is a computer adaptive, which means that the difficulty of the questions is adjusted as the student takes the exam. Examinees who answer questions correctly are given progressively harder questions until they miss one. The difficulty is then reduced until the examinee starts answering questions correctly again. The examinees receive a scaled score based on the number of correct answers they gave and the difficulty level of those questions. This is set on a scale of 0-1000. Examinees must receive at least 400 points to pass the exam. A different bank of questions is used each quarter or “cycle”.

Examinee performance is compared to the average score for university training programs and all examinees (National Average) for the cycle they took the exam. In the class which entered Spring 2004, one of the CLS students took the exam in a different cycle from the rest of his classmates. His score is compared to a different University and National average.(Table 3, Figure 1). His score is listed as “class 4(2)”.

The average score in each content area for students in the SJSU CLS training program (Table 4) is higher than the average for students of other university based program or the national average for all examinees in all cases except three. As a group, class 1 scored lower than students in other university based programs in the Laboratory operations category. Class 3 scored lower than both the University and National averages in Hematology and the individual who took the
exam in a different cycle ("class 4(2)") scored lower than the university and national average in urinalysis. These results indicate that overall, the average score of our students exceed the University and National Average the majority of the time and there are no trends that indicate that one particular subject area is weak.

Table 3: Total Score on the ASCP exam

<table>
<thead>
<tr>
<th></th>
<th>class 1 Fall 2002</th>
<th>class 2 Spring 2003</th>
<th>class 3 Fall 2003</th>
<th>class 3 Spring 2004</th>
<th>class 4 (2) Spring 2004</th>
<th>class 5 Fall 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>student A</td>
<td>673</td>
<td>769</td>
<td>484</td>
<td>470</td>
<td>559</td>
<td>679</td>
</tr>
<tr>
<td>student B</td>
<td>595</td>
<td>548</td>
<td>513</td>
<td>513</td>
<td></td>
<td>639</td>
</tr>
<tr>
<td>student C</td>
<td>646</td>
<td>545</td>
<td>545</td>
<td>530</td>
<td></td>
<td></td>
</tr>
<tr>
<td>student D</td>
<td>569</td>
<td>656</td>
<td>613</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>student E</td>
<td></td>
<td></td>
<td>516</td>
<td>722</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Averages:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>484</td>
<td>not available</td>
</tr>
<tr>
<td>University</td>
<td>488</td>
<td>511</td>
<td>487</td>
<td>511</td>
<td>484</td>
<td>not available</td>
</tr>
<tr>
<td>National</td>
<td>466</td>
<td>505</td>
<td>478</td>
<td>505</td>
<td>476</td>
<td>not available</td>
</tr>
</tbody>
</table>

Table 4: Performance of each class in different subject areas on the ASCP exam

<table>
<thead>
<tr>
<th></th>
<th>BBNK</th>
<th>CHEM</th>
<th>HEMA</th>
<th>IMMU</th>
<th>LO</th>
<th>MICR</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 (Fall 2002) Average</td>
<td>548</td>
<td>637</td>
<td>593</td>
<td>697</td>
<td>503</td>
<td>724</td>
<td>599</td>
</tr>
<tr>
<td>University Program Average</td>
<td>479</td>
<td>489</td>
<td>484</td>
<td>502</td>
<td>510</td>
<td>497</td>
<td>491</td>
</tr>
<tr>
<td>Cycle Average</td>
<td>454</td>
<td>473</td>
<td>460</td>
<td>471</td>
<td>501</td>
<td>468</td>
<td>477</td>
</tr>
<tr>
<td>Class 2 (Spring 2003) Average</td>
<td>671</td>
<td>654</td>
<td>655</td>
<td>578</td>
<td>627</td>
<td>740</td>
<td>558</td>
</tr>
<tr>
<td>University Program Average</td>
<td>518</td>
<td>497</td>
<td>519</td>
<td>514</td>
<td>517</td>
<td>513</td>
<td>503</td>
</tr>
<tr>
<td>Cycle Average</td>
<td>507</td>
<td>499</td>
<td>508</td>
<td>512</td>
<td>518</td>
<td>503</td>
<td>512</td>
</tr>
<tr>
<td>Class 3 (Fall 2003) Average</td>
<td>515</td>
<td>550</td>
<td>469</td>
<td>647</td>
<td>548</td>
<td>603</td>
<td>530</td>
</tr>
<tr>
<td>University Program Average</td>
<td>488</td>
<td>476</td>
<td>499</td>
<td>502</td>
<td>497</td>
<td>488</td>
<td>474</td>
</tr>
<tr>
<td>Cycle Average</td>
<td>481</td>
<td>470</td>
<td>483</td>
<td>489</td>
<td>502</td>
<td>471</td>
<td>480</td>
</tr>
<tr>
<td>Class 4 (Spring 2004) Average</td>
<td>540</td>
<td>591</td>
<td>607</td>
<td>519</td>
<td>619</td>
<td>548</td>
<td>549</td>
</tr>
<tr>
<td>University Program Average</td>
<td>502</td>
<td>497</td>
<td>527</td>
<td>509</td>
<td>520</td>
<td>519</td>
<td>516</td>
</tr>
<tr>
<td>Cycle Average</td>
<td>500</td>
<td>495</td>
<td>515</td>
<td>506</td>
<td>520</td>
<td>505</td>
<td>515</td>
</tr>
<tr>
<td>Class 4.2 (Spring 2004) Average</td>
<td>489</td>
<td>550</td>
<td>553</td>
<td>606</td>
<td>620</td>
<td>627</td>
<td>471</td>
</tr>
<tr>
<td>University Program Average</td>
<td>485</td>
<td>486</td>
<td>485</td>
<td>499</td>
<td>498</td>
<td>478</td>
<td>488</td>
</tr>
<tr>
<td>Cycle Average</td>
<td>484</td>
<td>474</td>
<td>472</td>
<td>486</td>
<td>496</td>
<td>468</td>
<td>483</td>
</tr>
</tbody>
</table>

BBNK = transfusion service, CHEM = clinical chemistry, HEMA = hematology, IMMU = immunology, LO = laboratory operations, MICR = medical microbiology, UA = urinalysis. Program averages below the University or National (cycle) average are bold.
Figure 1: ASCP exam scores are plotted by class, starting with the class entering the program Fall 2002. Averages for all University based programs and the National average for the exam cycle are also displayed. Data on the University and National average are not available for class 5 because the exam cycle ends December 2005. Note that only two students have composite scores lower than either the University or National average.

Graduates of the SJSU CLS training program are all employed in California clinical laboratories. A summary of their placements is listed in Table 5.
<table>
<thead>
<tr>
<th>Students</th>
<th>Trained at</th>
<th>First Employ</th>
<th>Employment now (10/05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall 2004</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CHOMP</td>
<td>CHOMP</td>
<td>CHOMP</td>
</tr>
<tr>
<td>2</td>
<td>Kaiser Santa Clara</td>
<td>Kaiser Santa Clara</td>
<td>Kaiser Santa Clara</td>
</tr>
<tr>
<td>3</td>
<td>SCVMC</td>
<td>SCVMC</td>
<td>SCVMC</td>
</tr>
<tr>
<td>5</td>
<td>Salinas Valley Memorial</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td><strong>Spring 2004</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Sequoia</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>2</td>
<td>Salinas Valley Memorial</td>
<td>CHOMP</td>
<td>CHOMP</td>
</tr>
<tr>
<td>3</td>
<td>CHOMP</td>
<td>Sierra Vista</td>
<td>Sierra Vista</td>
</tr>
<tr>
<td>4</td>
<td>Kaiser ST</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>5</td>
<td>SCVMC</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>6</td>
<td>O’Connor</td>
<td>O’Connor</td>
<td>O’Connor</td>
</tr>
<tr>
<td>7</td>
<td>Stanford</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>8</td>
<td>Kaiser SC</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td><strong>Fall 2003</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>O’Connor</td>
<td>O’Connor</td>
<td>O’Connor</td>
</tr>
<tr>
<td>2</td>
<td>El Camino</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>3</td>
<td>Kaiser SC</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>4</td>
<td>Stanford</td>
<td>Mineral Springs Lab</td>
<td>Kweah Delta</td>
</tr>
<tr>
<td>5</td>
<td>Salinas</td>
<td>Salinas</td>
<td>Salinas</td>
</tr>
<tr>
<td><strong>Spring 2003</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stanford</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
<tr>
<td>2</td>
<td>CHOMP</td>
<td>CHOMP</td>
<td>CHOMP</td>
</tr>
<tr>
<td><strong>Fall 2002</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SCVMC</td>
<td>SCVMC</td>
<td>SCVMC</td>
</tr>
<tr>
<td>2</td>
<td>Kaiser SC</td>
<td>Kaiser SC</td>
<td>Stanford</td>
</tr>
<tr>
<td>3</td>
<td>O’Connor</td>
<td>O’Connor</td>
<td>SCVMC</td>
</tr>
<tr>
<td>4</td>
<td>Stanford</td>
<td>Stanford</td>
<td>Stanford</td>
</tr>
</tbody>
</table>

CHOMP = Community Hospital of the Monterey Peninsula, Kaiser SC = Kaiser Santa Clara, Kaiser ST = Kaiser Santa Teresa, Ridgecrest Reg. Hosp = Ridgecrest Regional Hospital, Salinas = Salinas Valley Memorial Hospital, SCVMC = Santa Clara Valley Medical Center, Stanford = Stanford Hospitals and Clinics.
C) Student Demand

Each year, the SJSU CLS Training Program has experienced robust interest in enrollment (Table 6, Figure 2). The number of applications is usually greater in the Spring. The number of applications consistently exceeds the number of available internships. We are investigating the possibility of affiliating with additional hospitals to make a greater number of internships available.

<table>
<thead>
<tr>
<th>Year</th>
<th>Applied</th>
<th>Admitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2002</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Spring 2003</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Fall 2003</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>Spring 2004</td>
<td>41</td>
<td>8</td>
</tr>
<tr>
<td>Fall 2004</td>
<td>32</td>
<td>7</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>43</td>
<td>13</td>
</tr>
<tr>
<td>Fall 2005</td>
<td>50</td>
<td>11</td>
</tr>
<tr>
<td>Spring 2006</td>
<td>52</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 2. The total number of applications, number of students admitted and number of graduates is shown for each class, starting with the class that entered the program in Fall of 2002.

D) Societal need

Clinical Laboratory Scientists are a critical part of the health care team. They provide 60% of the information that goes into generating a diagnosis for a patient. Graduates of this program are entering the field at a time when workforce shortages threaten to compromise the quality and quantity of work that can be done in the clinical lab. In the Bay Area, 50% of all CLSs will reach retirement age in the next 10 years. Our graduates will replace these retiring workers and will help labs cope with the increasing workloads expected as baby boomers retire and the
number of diagnostic tests increases. Graduates of this program are trained in the cognitive, psychomotor and affective modes to be competent, knowledgeable, ethical health care practitioners. The bulk of the cognitive learning occurs through our lecture series but students are also expected to learn about the tests they are performing in the clinical practica by reading the Standard Operating Procedures for their tests and reviewing relevant reference texts. This learning is assessed through weekly exams in the lecture series and in final exams at the end of each clinical practicum. The students psychomotor skills are monitored by the practicing CLSs that train them in the clinical practica and the student’s competence is documented through checklists of skills which are signed by both the student and trainer. The student’s affective skills are enhanced through workshops on professional topics in the orientation for the program as well as throughout the year by the example of their trainers and co-workers. These skills are assessed at the end of each clinical rotation through a rotation evaluation form which rates the students’ communication skills, skills as a team member, their initiative, honesty, and attendance.

E) **Financial resources, viability, and efficiency**

The Hospital Council of Northern California has agreed to provide funding for this program through Summer 2008. After that time, the biology department will decide if it would like to incorporate this program into its budget. Given that the students in this program generate one third of all graduate enrollment in the department, it is likely that the department will elect to continue the program at that time.

Over the next five years, the CLS program will be expanding its role by offering continuing education opportunities on a quarterly basis at SJSU. The possibility of opening a phlebotomy program is also being investigated. To support these expansions, the CLS program will need to hire an additional part time staff person, possibly a licensed CLS. Income from the phlebotomy program should support hiring this additional person. In addition, if more that 5 clinical sites are added to the CLS program, the program director will likely need an additional staff person to help manage the students at those facilities.

F) **Interdependence of programs**

Students enrolled in the CLS program are required to complete prerequisite courses before they can start their training. These include several currently taught by the biology department including Microbiology 140 (Hematology), Microbiology 141 (Pathogenic Bacteriology) and Biology 107 / 107s (Immunology). Enrollment in these courses has grown as more interest has developed in the CLS program.

Microbiology 292, the CLS lecture course is open to graduate students in the department and they occasionally take it to help meet their requirements for the M.A. in Biology.

G) **Capacity to contribute to an academic field**

The CLS program provides continuing education opportunities for CLSs in the Bay Area, especially in subjects related to education and training. We are also planning to start a
phlebotomy training program. This will allow undergraduates to get experience in the healthcare setting, making them more competitive applicants for graduate programs in various allied health professions, including the CLS program.

H) Availability of instructional alternatives

Currently, only 12 CLS training programs exist in California. Less than 100 students graduate each year, far fewer than are needed to replace the growing number of retirees in this profession. In the Bay Area, only San Francisco State University has a CLS program. SFSU trains a maximum of 32 students per year, far fewer than the hundreds of licensed CLSs needed to keep up with the growing demand for laboratory services and to replace retirees. In addition, we train students on the central coast, at hospitals in Santa Cruz and Monterey. No one else serves those areas. The absence of adequate training opportunities in this region makes this program a high priority.
A. Centrality of Mission

Mission and Goals of the Program

The mission of the MS Molecular and Microbiology Biology (MS M&M) program is to prepare graduates for employment in the biotechnology industry or for further graduate-level training (Ph.D.) or preparation for professional schools. The MS M&M program provides students with a rigorous scientific environment in which they can develop the observational, technical, and deductive reasoning skills required for a successful career in molecular biology/microbiology. The specific program goals are to provide limited remedial upper-division coursework in the biological and physical sciences; provide advanced graduate academic instruction and laboratory experiences and a research thesis. As discussed in the MA program, the MS Molecular Biology/Microbiology program also provides for curricular flexibility to best meet the needs of the student and societal needs for graduate-level training by raising student awareness of issues in professional ethics and science-based public policy and it teaches effective communication of scientific ideas. For the success of the program, the students and faculty need to be provided with adequate teaching and research laboratory space, supplies, and equipment in order to foster an environment conducive to effective teaching, learning, research, and scholarship.

Program Contributions to the Mission of SJSU

The MS Concentration in Molecular Biology and Microbiology provides its students with advanced intellectual and practical skills required for successful careers in molecular biology, microbiology, genetics, and cell biology and it gives them a broad-based understanding of how these disciplines, and science in general, can be applied to meet societal needs.

B. Quality of the Instructional Program

The MS M&M program provides our graduate candidates with a variety of upper-division and graduate level courses that prepare them for their future careers. We have a broad spectrum of upper-division undergraduate courses with strong practical/laboratory components that students can take to make up deficiencies in their previous undergraduate training. These courses are listed in Table 1.
Table 1. Upper-division Undergraduate courses.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 105</td>
<td>Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 107</td>
<td>Immunology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 115</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 116</td>
<td>Molecular Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 121</td>
<td>Bioinformatics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 124</td>
<td>Mammalian Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 125</td>
<td>Mammalian Physiology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 131</td>
<td>Endocrine Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 135</td>
<td>Molecular Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 135L</td>
<td>Molecular Cell Biology Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 137</td>
<td>Introduction to Principles of Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 155</td>
<td>Hypothesis Testing</td>
<td>3</td>
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<tr>
<td>MICR 127</td>
<td>Microbial Physiology</td>
<td>4</td>
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<td>MICR 140</td>
<td>Hematology</td>
<td>4</td>
</tr>
<tr>
<td>MICR 141</td>
<td>Pathogenic Microbiology I</td>
<td>3</td>
</tr>
<tr>
<td>MICR 141L</td>
<td>Pathogenic Microbiology I Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>MICR 142</td>
<td>Pathogenic Microbiology II</td>
<td>3</td>
</tr>
<tr>
<td>MICR 142L</td>
<td>Pathogenic Microbiology II Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>MICR 170</td>
<td>General Virology</td>
<td>3</td>
</tr>
</tbody>
</table>

The Department’s graduate course offerings give the M&M graduates advanced in depth knowledge and training that greatly improves their chances for success in their future careers. These courses are listed in Table 2. Although many of the courses listed in Tables 1 and 2 are not specifically molecular or microbiology in nature, they do provide the students with knowledge and laboratory training, especially in physiology related areas. This is experience and knowledge that they will potentially encounter in their future careers. For example students trained in molecular biology who work in the biotech industry often encounter problems that involve working with animal models in which they may be doing toxicity testing or toxicokinetics. This mix of courses will give our graduates an advantage in the workplace.

One of the strengths of the M&M graduate program is our cadre of "bridge" faculty who have expertise in more than one program area and have developed interdisciplinary curricula and research projects. For example, Bio 218 (Evolution) is team-taught by faculty members in the Microbiology & Molecular Biology area along with Conservation Biology & Ecology faculty. This brings together students and faculty from both concentrations who would otherwise never take or teach classes together. The Conservation Genetics Laboratory has been a meeting place in the Department where molecular genetics and conservation biology MS students can learn from each other to work on projects involving locally
Table 2. Graduate Courses for M&M Graduate students

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 201</td>
<td>Graduate Seminar in Biological Sciences</td>
<td>0.5</td>
</tr>
<tr>
<td>BIOL 202</td>
<td>Graduate Studies in Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 205</td>
<td>Advanced Molecular Techniques</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 210</td>
<td>Molecular Mechanisms of Cellular Activation</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 215</td>
<td>Seminar in Advanced Genetics</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 221</td>
<td>Bioinformatics</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 223</td>
<td>Radiation Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 227</td>
<td>Advanced Physiology/Pharmacology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 255M</td>
<td>Seminar in Advanced Biology: M&amp;M</td>
<td>1-3</td>
</tr>
<tr>
<td>BIOL 255P</td>
<td>Seminar in Advanced Biology: Physiology</td>
<td>1-3</td>
</tr>
</tbody>
</table>

Endangered and threatened species of wildlife. Another strength of the program is the depth and currency of our graduate laboratory offerings. Biology 227 (Physiology and Pharmacology) is the only course of its kind in the region and is intensely sought after by our Physiology graduate students. As a way of improving the graduate curriculum even further, the department decided to offer Advanced Biology Seminars (Bio 255M & P) each semester. These special topic seminars (e.g., Cell Signaling Mechanisms, Gene Therapy, Space Physiology, Physiology of Vision, Pathophysiology, etc.) have greatly enhanced the traditional lecture/laboratory curriculum.

Ultimately, the best indicator of program quality is the ability of our graduates to compete successfully in the job market and go on to fulfilling careers or gain entry to professional schools. By that indicator, our graduate program has been remarkably successful. The addition of several new faculty over the past five years has increased the amount of graduate research and modernized the curriculum. Infrastructure constraints and the loss of laboratory space to other expanding departments are the only issues on the horizon that may have a negative impact on program quality.

C. Student Demand

According to the latest SJSU Statistical Abstract, the total graduate population in the M&M program (both MA & MS) ranged from approximately 10-35 over the past five years. The data in Figure 1 show a peak of students in the 2002 academic year. About three years ago the graduate program in Molecular and Microbiology included students enrolled in both thesis and nonthesis programs and this would account for the large numbers of students that were categorized as graduate students in M&M. The department subsequently made the decision to separate the students into the MS thesis program that would be designated as Molecular and Microbiology and all nonthesis graduates would be put into the MA Biological Sciences degree. The subsequent drop in M&M graduate students as reflected in Figure 1 after the 2002 academic year occurred as a result of including only thesis students in the MS M&M program and from the graduation in 2004 of the large cohort from 2002 as shown in Figure 2. Although the student numbers in the MS program appear to be in decline they may actually be on the rise beginning in the Fall of 2005. Figure 3 shows the enrollments per semester in the M&M graduate course.
Figure 1. Graduate students enrolled in Molecular & Microbiology Masters programs (MS & MA).

Figure 2. Graduation History of the Molecular & Microbiology Graduate Programs (MA & MS)

offerings for academic years 2000 to 2004 and includes the fall of 2005 enrollments. The almost doubling of the fall 2005 enrollments may be a harbinger of future demand in the MS M&M program. The enrollments in these graduate courses also reflect increased demand from students in other graduate programs that include the Organismal, Systems Physiology, and the Masters in Biotechnology (MBT) programs.

D. Societal Need

The need for entry-level molecular biologists and microbiologists has held steady over the past several years due to the biotechnology and related health care industries. Our location in the Bay Area which has the highest concentration of these kinds of companies in the world requires graduates from our program. Many M.S. Molecular Biology Microbiology program graduates continue to advanced training in graduate and professional schools.
E. Financial Resources, Viability, and Efficiency

Nearly all of the funding for instructional materials in the graduate program is provided by the Department. The Department’s equipment budget is far too low, so high-end laboratory instrumentation must come from other sources (College of Science, Lottery, outside grants, donations, and self support programs). One major concern that has been precipitated by acquiring new equipment is the high-cost of service contracts. Much of our new equipment cannot be serviced by our own technicians and the cost of service contracts can be $5000 to $10,000 per year per item.

The Department decided almost ten years ago to allow the graduate program to grow to a point where a slightly larger variety of graduate courses could be given. This shift has allowed the program to grow without greatly increasing the resources needed by the program. It has grown, however to a point where the time and energy demands of the faculty have reached a level that the faculty has more-or-less agreed to keep the number of graduate students level for some time. The limited number of faculty who accept and support these students presents the greatest limitation to the program.

F. Interdependence of Programs

The M.S. Molecular Biology and Microbiology students populate our graduate and upper division courses, serve as graduate assistants in our courses, and go on to successful careers, and graduate and professional programs. They contribute in a positive way to supporting the department graduate and undergraduate programs. Many of the graduate courses and upper division courses or sections would not be taught without the support of the students in this program. Many of these students serve as graduate assistants in our laboratory courses that would be otherwise staffed by tenure track faculty.

G. Capacity to contribute to an Academic Field
Table 3 summarizes the professional activities of the M&M faculty over the past five years. The faculty have been very active in seeking outside funding for their activities (both academic programs and research) that supports the graduate students’ research activities and in publishing and reporting on their activities.

<table>
<thead>
<tr>
<th>Professional Activity</th>
<th>Numbers</th>
</tr>
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<tbody>
<tr>
<td>Scientific Publications</td>
<td>21</td>
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<tr>
<td>Published Abstracts</td>
<td>13</td>
</tr>
<tr>
<td>Grant Proposals</td>
<td>28</td>
</tr>
<tr>
<td>Technical Presentations</td>
<td>8</td>
</tr>
<tr>
<td>Consulting</td>
<td>1</td>
</tr>
<tr>
<td>Peer Reviewing</td>
<td>3</td>
</tr>
<tr>
<td>Outreach</td>
<td>12</td>
</tr>
</tbody>
</table>

**H. Availability of Instructional Alternatives**

Other Bay Area universities (UCSC, UC-Berkeley, UCSF, Stanford, SFSU, and CSU East Bay) offer graduate training in biological sciences. Only SFSU, and CSU East Bay offer a Mater’s as their terminal graduate degree, and neither of the two nearby CSU campuses, offer an M.A. Biological Sciences. San Jose State University is unique in the region in this respect. All of our graduate programs suffer from smaller classes and heavy work loads for faculty. We have lost a considerable amount of FTES in our General Education program, student faculty ratios have increased as the number of students increase and the number of tenure track faculty decrease. The Department continues to work at the balancing act between large classes and the diversity of classes needed to support our diverse graduate program.
Enrollment Numbers

Academic Year

Molecular Biology Course Enrollments

- Enrollments

FTES
MS Biological Sciences, Concentration in Organismal & Conservation Biology

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graduate Courses in Biology</strong></td>
<td>4</td>
</tr>
<tr>
<td>BIOL 201 and BIOL 202</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Graduate Course</strong></td>
<td>1-4</td>
</tr>
<tr>
<td>Any approved 255 course (any department prefix or suffix)</td>
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</tr>
<tr>
<td><strong>Thesis</strong></td>
<td>1-3</td>
</tr>
<tr>
<td>BIOL 299</td>
<td></td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td>19-24</td>
</tr>
<tr>
<td>100- or 200-level courses chosen with advisor consent</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units:</strong></td>
<td>30</td>
</tr>
</tbody>
</table>

A. Centrality of Mission

The M.S. in Organismal and Conservation Biology has formally been in existence only during the previous planning period. Therefore, there are no statistical comparisons of program size, graduation rates, student duration in the program, or other useful indices of program status. Evaluation is based largely on whether the numbers within the past five years as well as the perceived quality and smoothness of the program match faculty wishes. Our own assessment is that the program is currently healthy and sound. Regarding the relationship of the program’s mission to that of SJSU, there is a perfect fit as our program aims to improve the understanding of critical social issues (species diversity, habitat conservation, and ecology) and fundamentals of biology (organismic biology, natural history) that citizens of California need and, in particular, the Bay Area requires for its sustainable development.

B. Quality of the Instructional Program

The curriculum includes required courses and units, such as Bio 6, 201 (taken twice), 202, 298, and 299 plus advisor-approved electives totaling a minimum of 15 graduate (200-level) units and 30 overall units. Among the requirements are the 1-3-unit graduate seminar course (Bio 255E) and the 3-unit Evolution course (Bio 218). The Bio 255E courses are offered one per semester, and the topic and instructor revolve through the area faculty. Enrollment in these seminars has been excellent with only two or three course cancellations being necessary during the planning period. Numbers exceeding 20 students have not been unusual. Similarly high enrollments have characterized the Bio 218 course, the evening time of this class and its attractiveness to both organismal and molecular students contributing to its enrollment success.

The nature of the research pursued in this graduate program varies specifically with faculty (master’s committee chairperson) interests, facilities, capabilities, and number and kinds of outside contacts. The majority of graduate students conduct field research to some extent. Much of this work is ecological, although important research on taxonomy and systematics, evolutionary biology, animal feeding habits, human impact on the
environment, and human remediation of the environment is also done. In addition, collection of specimens for subsequent laboratory analysis, whether it be genetical, anatomical, or physiological, is common.

These kinds of research tie directly into the general goals of the program. The program seeks to prepare students for professional careers in organismal, ecological, and/or conservation biology, including improving their chances and desire to be admitted to Ph.D. programs. Skill sets differ according to the particular research interests of the individual.

Program quality with respect to student outcomes can be assessed at this time only by anecdotal evidence and by the trends observed by the faculty. Direct student assessment has not been solicited. Graduation rates have been good, with most students who start the program eventually receiving degrees (about 22 students having completed the M.S. within the past review period). Similarly, postgraduate success also appears good, with most degreed students entering the work force or Ph.D. programs in their field of interest. Student complaints are few.

C. Student Demand

The faculty members in the O&E area for the most part eschew the M.A. (non-thesis) program for their students. The reasons range from a general philosophical aversion to the non-thesis degree to a sentiment that the non-thesis degree prepares our students inadequately for the majority of postgraduate opportunities available. Many, however, are simply rarely asked to supervise a non-thesis student in this area.

Faculty expectations for the M.S. in Organismal and Conservation Biology are being met by the current numbers and quality of the graduate student population. The program serves faculty needs for intellectual stimulation, for keeping a finger on the pulse of current research, and for greater depth and breadth of involvement in research activities, whether for our own interest or for career advancement. None of the faculty feel any need to alter the current application/admission process, and none are unhappy with the quality of our own or other graduate students in the program. The number of M.S. (Plan A) graduate students per O&E faculty member is high (averaging 3-4, including faculty soon retiring and faculty recently hired for a total of about 36), so the program is nearly maximally enlisted. This corps of students in our upper-division and graduate courses has frequently allowed the courses to avoid cancellation due to lack of adequate enrollment. Faculty morale receives a substantial boost as a result. Teaching assistants are also more likely to be found among a group this large, which helps not only the faculty in O&E but also in the Department at large. O&E faculty might consider the benefits of increasing its admission of M.A. students for these purposes. Overall, the O&E area is “top heavy” in the sense that the heavily enrolled M.S. program surpasses the low enrolled B.S. program. This characteristic, which we feel best fits the needs of the community we serve, should be taken into account when the health and quality of the organismal and conservation program as a whole are scrutinized.
D.-H. Societal Need, Resource Needs, Interdependence, and Capacity to Contribute

It might be noted that the number of qualified applicants to the program is far greater than the number of admissions. Given a larger faculty, the graduate program would be enlarged proportionally. However, the limitations on graduate admissions lie with the number of faculty members and the cost of each student to the faculty member. The time spent with a graduate student and his/her thesis is considerable and goes predominantly uncompensated (by teaching units, salary, or diversion from other tasks). Research costs in the area are small in most of the field applications but large in the lab applications. Younger faculty members who have combined field/ ecological/organismal research with molecular methodology have generally fared well in acquiring outside funding to support their own graduate students. Other faculty members have received moderate funding or require their students to fund their own research. The model of laboratory self support is carried over from research institutions where extramural funding is arguably easier to procure and may not be a reasonable fit for a teaching university. In addition, our program suffers from the same infrastructural hindrances as the other areas of the Department, although to a lesser degree because of the more economical nature of field research. Thus the decay of equipment, the absence of service contracts or personal trained in maintenance of specialized equipment, and the absence of equipment budgets, especially for large ticket items that funding agencies rarely fund, obstruct research plans. Awards of startup funds by the College of Science in recent years are applauded and have gone a long way toward alleviating a bottleneck in early career research productivity and in providing some expensive apparatus that will be used for many years to come.

I. Summary

Overall, the area feels comfortable with the M.S. program as it now stands. Nevertheless, with the imminent retirement of Drs. Kutilek, Matson, Balgooyen, St. Omer, and Kenk and recent retirement of Dr. Myatt, the number of students within the graduate organismal program will diminish. All of the benefits associated with these numbers will also diminish, even while remaining faculty members universally take on a reasonable load of graduate student supervision. This quandary will only be overcome by the hiring of more faculty in this area. Of the names above, three are vertebrate biologists. Only one professor in this vital area will remain. To maintain a reasonably complete, if only bare bones, program in organismal biology, a new hire will become necessary within a short period of time.
MS Biological Sciences, Concentration in Physiology

Course Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Courses in Biology</td>
<td>5-7</td>
</tr>
<tr>
<td>BIOL 201, BIOL 202 and BIOL 284</td>
<td></td>
</tr>
<tr>
<td>Additional Biology Course</td>
<td>1-3</td>
</tr>
<tr>
<td>BIOL 227 or BIOL 255P</td>
<td></td>
</tr>
<tr>
<td>Thesis</td>
<td>1-3</td>
</tr>
<tr>
<td>BIOL 299</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>20-24</td>
</tr>
<tr>
<td>100- or 200-level courses chosen with advisor consent</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 30

A: Centrality to Mission

Mission and Goals of the Program
The mission of the M.S. Biological Sciences degree in Physiology is to prepare students for employment in their chosen field, doctoral level training or successful application to professional schools such as medicine and dentistry. The general program goals are to provide students with a rigorous intellectual environment in which they can develop the observational, technical and deductive reasoning skills required for a successful career in the biological and health sciences. Specific goals are to provide advanced academic instruction and laboratory experiences with topical flexibility to meet the demands of a rapidly changing discipline and related work environment.

Program Contributions to the Mission of SJSU
The M.S. in Physiology provides students with the intellectual and technical skills necessary to make substantial contributions to the local, growing biotechnology industry and to compete successfully for entrance into doctoral and professional schools. In short, the program provides our graduates with the means to respond to a variety of societal needs.

B: Quality of Instructional Program

Graduate Level Courses Taught by Anatomy and Physiology Faculty

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 227</td>
<td>Advanced Physiology/Pharmacology Laboratory</td>
</tr>
<tr>
<td>BIOL 223</td>
<td>Radiation Biology</td>
</tr>
<tr>
<td>BIOL 230</td>
<td>Comparative Animal Physiology</td>
</tr>
<tr>
<td>BIOL 240</td>
<td>Scanning Electron Microscopy in Biology</td>
</tr>
<tr>
<td>BIOL 255P</td>
<td>Seminar in Advanced Biology: Physiology</td>
</tr>
</tbody>
</table>

Biology 233 and 230 have been offered periodically in the last five years. Recent offerings in the 255P series include courses in Pathophysiology, Advances in
Immunotherapy and the Physiology of Vision. These courses are well attended and staffing has been consistent. Nevertheless, there are two issues of concern: staffing for the other graduate-level courses and instrumentation.

The quality of this program is seriously threatened by the decreased number of tenured and tenure-track faculty. Two of the above-listed graduate courses (BIOL 227 and 240) have not been offered for several years either because faculty have retired or have taken advantage of consultation opportunities. These courses are the only laboratory courses to be offered in the program. At this time, students must therefore learn and improve their laboratory skills within the research lab of their major professor. While this is a workable solution, it does not always provide the community experience of a laboratory course. This kind of experience provides the student with group dynamic skills they may not acquire in the research lab. Students may, of course, take courses offered by other areas in the department, but this does not provide students with the intensive physiology experience that should expect of this program and that we hope to provide.

The second issue of concern is instrumentation upgrades. The recent acquisition of a state-of-the-art scanning electron microscope in collaboration with faculty in the Chemical and Materials Engineering Department within the College of Engineering has provided the technical basis for reactivating Biology 240 should appropriate faculty be hired. Biology 227, however, is in need of a technical upgrade and staffing.

The quality of the program is ultimately judged by its graduates. The numbers of students completing the MS degree has been consistent but low. Nevertheless, these students have been extremely successful in continuing into doctoral programs, working in industry and in successful application to professional schools.

Program Plan
The new Anatomy and Physiology faculty member to be hired in the current search (should it be approved) will most likely spend a great deal of time working in the area’s service courses and developing their own research program. It is not likely that they would take on the reorganization of an extremely complex course such as Biology 227 in the near future. To maintain the quality of the program additional faculty must be hired.

C: Student Demand
The total number of students in the M.S. program has remained rather stable over the last five years. It is expected that this number will rise slowly because of the increase in the local biotechnology industry and the need for health care professionals as the country’s population grows older. Nevertheless, this increase will be limited by the decreased number of faculty and the availability of current faculty to accommodate graduate students.
D: Societal Need
As the population ages there will be a growing need for physicians and other health care professionals. In addition the local biotechnology industry is expected to grow tremendously. The M.S. program in physiology at SJSU is well situated to make its contribution in the form of well-educated, enthusiastic graduates.

E: Financial Resources, Viability and Efficiency
Nearly all of the funding for instructional materials in this program is provided for by the department. Purchase of new instrumentation for the service physiology course is an example. Such purchases, however, are infrequent and aperiodic and cannot respond adequately to technical developments in the workplace outside of the university. As a result, our students are well-prepared for some few years and then their technical experience begins to lag behind that required for a competitive advantage in the market. The Department's equipment budget is far too low and so the acquisition of expensive instruments must await funding from other sources (usually extramural funding based upon faculty generated grants). An example of this is the recent acquisition of a scanning electron microscope mentioned above.

Successful competition for extramural funding is, however, problematic in that it requires significant amounts of time to generate data for a proposal and then to write the proposal itself. Faculty already have significant restraints on their time and energy.

F: Interdependence of Programs
Graduate students in this program are an essential source of teaching assistants for the department. They make substantial contributions to the staffing of our large and growing service courses in anatomy and physiology. In addition, courses offered by physiology faculty are often considered as electives for those MS students in other concentrations and by MA students as well.

G: Capacity to Contribute to an Academic Field
Several faculty members within the Anatomy and Physiology program area have obtained extramural funding and most have recently published original research. Some have long-standing track records of publication in their discipline and have established collaborations with such entities as NASA Ames Research Facility in Mountain View and U.C. Berkeley. Undergraduates benefit directly from faculty research efforts that are, in part, supported by the MARC and MBRS programs. Graduate students collaborate in published research and present at scientific meetings at the local, state and national and international levels.
A&P FACULTY ACTIVITY 2000-2005

<table>
<thead>
<tr>
<th>Category</th>
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</tr>
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<tbody>
<tr>
<td>Journal Publications</td>
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<td>Published Abstracts</td>
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<td>Professional Presentations</td>
<td>08</td>
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<td>Grants</td>
<td>11</td>
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<tr>
<td>NSF Principal Scientist</td>
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<td>NSF Program Director (PI)</td>
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<td>Private Contributions</td>
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<td>DARPA Sr Program Scientist,</td>
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<td>Consultant</td>
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<td>NASA</td>
<td>3,000</td>
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<tr>
<td>TOTAL</td>
<td>$1,625,000</td>
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</table>

Faculty continue to be active in their research and efforts to improve their teaching. Nevertheless, productivity is threatened by the lack of new faculty in the area. Opportunities to collaborate within the department would be an impetus to success in seeking extramural funds and would enrich the academic lives of our faculty and students.

II: Availability of Instructional Alternatives

Masters in Physiology programs exist at other CSU campuses in the Bay Area. Nevertheless, the program at SJSU is extremely viable as it exists within reach of the growing Biotechnology community in the South Bay.
The Master of Biotechnology (MBT) Program

<table>
<thead>
<tr>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graduate Courses in Biology</strong></td>
</tr>
<tr>
<td>Biol 202T-a,b,c; Biol 205T; Biol 221T; Biol 280T; Biol 285T</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td><strong>Graduate Courses in Science</strong></td>
</tr>
<tr>
<td>Sci 281T-a,b; Sci 283T-a,b</td>
</tr>
<tr>
<td>6-9</td>
</tr>
<tr>
<td><strong>MBA Courses</strong></td>
</tr>
<tr>
<td>Bus 282-a,b,c; a possible elective</td>
</tr>
<tr>
<td>7-10</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
</tr>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

A. Centrality to Mission

Mission and Goals of the MBT Program

The mission of the Master of Biotechnology Program is to prepare graduates for productive careers in the biotechnology industry and to provide them with a rigorous scientific and learning environment in which they can develop the observational, technical, and critical thinking skills necessary for such success. The specific program goals are to provide advanced academic instruction and laboratory training, integrating courses in fundamental business practices, along with seminars that incorporate significant team-projects. In addition, the curriculum has been devised to raise student awareness of issues in professional ethics and behavior, science-based public policy, and to teach effective communication of scientific and commercial ideas. The MBT curriculum offers core master’s-level courses along with a selection of elective courses which allow graduates to learn fundamental concepts in molecular cell biology (the basis of the biotechnology field) while gaining experience in related and complementary fields. In addition, the MBT program strives to provide students and faculty with adequate, up-to-date teaching and laboratory space, supplies, and equipment in order to foster an environment conducive to effective teaching, learning, and scholarship. This environment will encourage the faculty to provide students with an understanding of the latest advances in biotechnology.

Program Contributions to the Mission of SJSU

The MBT program provides its students with the advanced intellectual and practical skills required for successful careers in biotechnology, particularly in the industries and educational institutions of the San Francisco Bay Area.
B. Quality of Instructional Program

The Master of Biotechnology Program has a highly integrated, yet focused, curriculum that combines the strengths of the tenured and tenure-track faculty in both College of Science and the College of Business, thereby providing an outstanding and unique educational experience to the students. The MBT degree requires 10% more course work (a total of 33 units) than the M.A. in Biology, to effectively integrate the two fields of study. The students proceed through the core curriculum (21 units) as a cohort, thus enhancing their team-project exercises and networking opportunities. Specifically, the students are required to enroll in the MBT versions of two of the most rigorous courses offered in the Department of Biological Sciences (Biol 205T and Biol 221T) which are taught by two of the most respected professors (Brinegar and Matthes). The MBA component of the MBT curriculum is a focused series of courses (Bus 282-a,b,c) that covers Organization Management & Behavior, Operations Managements, and Management of Technical Innovation in the Biotechnology Industry. These fundamental science and business concepts are incorporated in the seminar series Biol 202T-a,b,c which integrates these concepts into oral and written communication exercises and team-projects relevant to the biotechnology field. These three 2-unit courses are coordinated and taught by the director of the MBT program; experts from the industry present lectures on technical, commercial, and ethical issues for analysis by the students; extensive writing assignments fulfill the 200W requirements for the graduate degree. The elective courses, Sci 281T-a,b and Sci 283T-a,b, provide the student opportunities to customize the acquisitions of skills relevant to the biotechnology industry. For example, Advanced Immunological Techniques and Virology are two, Sci 281T, electives in high demand by MBT students. The electives in Regulatory Affairs (Sci 283T) are also valued by the students and their employers; fortunately, we have been able to partner with San Diego State University’s Master of Science in Regulatory Affairs Program in offering this specific content. This latter skill is in high demand by the biotechnology industry which increasingly needs to develop human therapeutics under FDA scrutiny of cGXP R&D and operations. Possibly the most valuable course in the curriculum is the required, two-unit Biotechnology Internship. This provides the student with a meaningful exposure to their industry of choice, the challenge of obtaining and successfully completing an industry interview, an opportunity to form a useful network, a sense of the corporate environment, and in many cases develops into their first offer of employment after (and even before) graduation.

The MBT program is entering its third year, however, there have been significant adjustments to the curriculum in each year. We anticipate continual improvements in the curriculum as it responds to the input of our industry advisory board, the students, and the faculty council. The current curriculum is shown in Figure 1. One issue that the MBT program faces in the immediate future is the lack of qualified tenure-track faculty to expand the electives of the program and to rotate with the existing faculty in offering the core courses. Unless there is a remedy for this problem, it may
## Figure 1

<table>
<thead>
<tr>
<th>1st Year</th>
<th>2nd Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td><strong>Spring</strong></td>
</tr>
<tr>
<td>BIOL 205T (4 units) ADVANCED MOLECULAR TECHNIQUES FOR BIOTECHNOLOGY</td>
<td>BIOL 221T (4 units) ADVANCED BIOINFORMATICS FOR BIOTECHNOLOGY</td>
</tr>
<tr>
<td></td>
<td>Laboratory techniques for the modern molecular biologist.</td>
</tr>
<tr>
<td>BIOL 202T-A (2 units) PROFESSIONAL MASTER’S STUDIES IN BIOENGINEERING SEMINAR</td>
<td>BIOL 202T-B (2 units) PROFESSIONAL MASTER’S STUDIES IN BIOENGINEERING SEMINAR</td>
</tr>
<tr>
<td>Seminar focusing on current practices in the biotechnology industry; emphasizes written and oral communication; team-project required.</td>
<td>Seminar focusing on current practices in the biotechnology industry; emphasizes written and oral communication; required team-project: company analysis.</td>
</tr>
<tr>
<td>BUS 282-A (2 units) ORGANIZATION MANAGEMENT</td>
<td>BUS 282-B (2 units) OPERATIONS MANAGEMENT</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

3
become necessary for the program to prepare and hire temporary faculty to teach in this program which might affect the program quality.

The students greatly benefit from the unique didactic of the MBT Program curriculum. Combining MBA course work with a core lab sciences and integrating them in a team-project oriented, communication-rich seminar series provides a unique approach to graduate science education. It’s too early to provide statistically meaningful assessment of the MBT graduates appreciation of the program, however, anecdotal responses from both the graduates and their employers suggests that the MBT degree will be highly valued. The expressed interest of the students is to develop careers in the biotechnology industry. At last count 87% of the 18 graduates were employed in some biotech-related endeavor. In fact, more than 50% of the last graduating class had offers or were employed prior to graduation.

C. Student Demand

Student demand is assessed by the number of inquiries and applications for each year’s class. Over the past 3 years, we’ve had over 45,000 hits on the MBT website. This has generated 882 inquires by phone, email, or in person which developed into 129 completed applications. We accepted 58 of those applicants; 56 enrolled; 18 have graduated and there are currently 34 students in the program (Figure 2). The capacity of the program is 18 students per class for a total of 36. Each year at least one student who started the program withdrew because of the rigorous demands of the program.

Figure 2

<table>
<thead>
<tr>
<th>Fall of year</th>
<th>Inquires Email</th>
<th>Inquires Phone</th>
<th>Applicants</th>
<th>Concurrent Students</th>
<th>Graduates</th>
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<tr>
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<td>10</td>
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<tr>
<td>2003</td>
<td>110</td>
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<td>44</td>
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<td>264</td>
<td>78</td>
<td>35</td>
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</tr>
<tr>
<td>2005</td>
<td>187</td>
<td>39</td>
<td>40</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>2006</td>
<td>118</td>
<td>26</td>
<td>c4</td>
<td>e35</td>
<td>e15</td>
</tr>
<tr>
<td>2007</td>
<td>c143</td>
<td>c32</td>
<td>c4</td>
<td>e15</td>
<td>e15</td>
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</tbody>
</table>

c indicates numbers that are current totals as of 11/10/05
e indicates expected enrollment and graduation numbers

The numbers above must be viewed in the light of the newness of the program and the increasing stringency that has been applied to the application process. Three years ago we only recommended the GRE exam for admission. Since then we have required not only the general GRE but also the subject exam; in addition, the fees for the program were increased 20% this fall. In spite of increasing the barriers to admissions, student interest in the program remains very strong. There is every reason to believe that interest
in this degree will only increase with time, not only from recent Bachelor’s but from employees in the industry as they interact with the graduates holding the MBT degree.

The goal of the program is to prepare graduates for careers in the biotechnology industry. While this is not yet a recognized academic discipline, it does incorporate skills from several organized disciplines (Biochemistry, Genetics, Microbiology, etc). On occasion, a graduate does go on to a PhD program; one of our recent graduates is currently enrolled in the joint PhD/MBA program at SDSU. A few of the current students have also expressed interest in pursuing higher degrees or (as the case of one recent student), an MBA.

D. Societal Need

The Master of Biotechnology Program was instigated in response to a perceived demand for science-trained managers for the biotechnology industry. This perception was brought into focus by conversations with representatives from local biotech companies and from interactions with the outreach personnel from the Alfred P. Sloan Foundation. The Sloan had been promoting what has become know as Professional Science Master’s as an alternative to PhD-training of scientists. The convergence of these concepts with the abundance of students at SJSU interested in biotechnology, the universities geographic proximity to an employer-rich environment, and its suitability as a Master-granting institution supported the idea of developing a new curriculum.

Perhaps the hardest metric to establish is societal need. Certainly, society will be in continual pursuit of the products from the biotech industry. To the extent that the industry improves the quality of life in our society, the workforce that delivers those products will be valued and needed. Students are selected for their rigorous and appropriate academic backgrounds; only about half of the qualified applicants are accepted into the program (Appendix Y). These students are further challenged, not only by a rigorous academic curriculum, but also with ethical and moral issues that surround the biotechnology industry. Discussing these issues in the multi-cultural, multi-disciplinary environment of the MBT program prepares the graduates for future leadership positions in the industry.

Though early in its development, the Master of Biotechnology program and its graduates, MBT degree holders, appear to be valued by the biotechnology industry; an industry sector that is increasingly important to our global society. As mentioned above a very large percentage of the graduates obtain employment soon after graduation, if not before. In addition, the average median salary of MBT graduates seems to be significantly greater than a comparable MS graduate. The MBT graduate will be valued by society to the extent that society values degree holders who are well educated and able to grasp the intricacies of the moral and ethical issues imbedded in biotechnology.
E. Financial Resources, Viability, and Efficiency

The MBT program is in the Department of Biological Sciences; its degree is conferred by the College of Science. The program is a Special Sessions program and operates entirely on its own resources. The program was initiated with a $75,000 seed grant from the Alfred P. Sloan Foundation and matching funds from the College of Science; in addition, “in-kind” contributions from the Department of Biological Sciences were provided in the form of faculty involvement with the planning of the program. The infrastructure for the core courses of the program was developed using a variety of resources and donations over the 5-10 years preceding the proposal for the program. To ameliorate the impact of the MBT program on department resources, the Provost, and Deans of Science and International & Extended Studies contributed $154,000 of equipment to the Department in the start-up phase of the program.

On this foundation, the MBT program launched in January of 2003 with its pilot class. Since then, the program has continuously operated with a small but positive revenue. Adjustments to the fee structure have been made to accommodate unexpected costs levied on the program. Below is a financial snap-shot of the program as of May 2005:

- The program has $28,601 cumulative net revenue as of 5/05
- The program’s current operating budget is approximately $350,000 per year
- The program fees have been increased to $23,000 per student per 2-year program
- The program reimburses the College and Department for the salary and benefits of all the personnel who support the MBT program
- The program reimburses the Department for all reagents used for instruction of the program courses
- The program generates funds for IES (International and Extended Studies), CoB, and CBBD (Center for Bio/Pharmaceutical and Biodevice Development at SDSU (San Diego State University))

The financial projections indicate that the program will continue to prosper and that it will have resources sufficient to allow for programmatic development and enhancement that should benefit the program, Department of Biological Sciences, and the College. However, the greatest challenge for the program is securing reliable, consistently available, high-quality faculty for the courses in the program. At this time, the program has neither the authority nor the capacity to hire tenure-track faculty. Should the Department and/or College be unable to hire such faculty, the quality of the MBT program may be adversely affected. On-the-other-hand, increasing the number of relevant faculty and making minor changes in the infrastructure of the laboratories would allow for growing the program to twice the current size, thus accommodating the anticipated increase in student demand and employer need.
F. Interdependence of Programs

The MBT program intersects with the MS/MA program in the Department of Biological Sciences particularly: the Molecular-Microbiology (M&M) Area. Students in the MBT program take core classes that were developed by and are taught by faculty from the M&M area, though the MBT courses are essentially taught separately. Some MBT students choose electives from the regular session courses, for which the MBT program reimburses the Department. These overlaps are financially neutral for both parties; however, the students and faculty benefit by sharing differing perspectives during the courses activities.

The most obvious interdependency is with the MBA program in the College of Business. It is an integral and essential part of the program which underpins its utility and uniqueness. The close collaboration between the Director of the MBT program and the administrators and the faculty in the College of Business has served as a source of curriculum development and as a conduit of cultural exchange between the two colleges. The interdisciplinary nature of the MBT degree is highly praised by the employers in the biotech industry and is the primary motive for the applicants to the program. Student from both Colleges clearly benefit from their interactions. The faculty who serve on the MBT council from both Colleges have also expressed appreciation for being able to share perspectives on common issues. Our hope is that these interactions will diffuse to the rest of the faculty and students.

In addition to the interactions of the MBT with other graduate programs within and outside of the Department is the availability of department undergraduate courses as prerequisites for the MBT applicants. Each year several students, usually with bachelor degrees from other institutions and countries apply to the MBT without sufficient academic experiences in laboratory sciences to assure their success in the graduate courses. Those students are encouraged to enroll in appropriate upper-division courses through the Open-Univeristy or Post-Baccalaureate options.

Finally, the MBT students contribute to the teaching assistant pool for the department, assisting with the labs for the lower-division courses.

G. Capacity to Contribute to an Academic Field

No formal academic field of Biotechnology exists, currently. However, the industry of biotechnology developed from the disciplines of Cell Biology, Biochemistry, Immunology, Pharmacology, Molecular Biology, Developmental Biology, etc. There are practicing faculty members in all of these disciplines in the Department who teach both introductory and advanced course in those disciplines. While the MBT students are not required to do academic research for their degree, many of the students serve as Teaching Assistants in the courses and some of the MBT students do research projects in a professor’s lab as one of their electives. The MBT student’s research experiences are primarily in the companies of the industry where they perform their internships. Though
these efforts will not usually be published for reasons of propriety, the feed-back from the mentors of the interns and the fact that many are later retained as employees suggests that the students are contributing in meaningful ways to an enterprise that will continue to impact humanity for the foreseeable future.

H. Availability of Instructional Alternatives

This program is unique to the California State University system. To our knowledge, no similar program is offered nor planned to be offered in the University of California system, nor at any private institution in northern California. The closest related programs in northern California are: an undergraduate BS in biotechnology (technology focused) at UC-Davis, an undergraduate minor in Biotechnology from Santa Clara University and a recently implemented program at Fresno State University for a Professional MS in Agricultural Biotechnology. In addition, one-year Certificate in Biotechnology programs exist at CSU-Hayward and CSU-Fresno. Less technical and less rigorous, one-year Certificate programs are offered from a variety of non-CSU institutions in the Bay Area, including: UCSC-Extension, Foothill Community College, and Skyline Community College.

A private institution in southern California, the Keck Graduate Institute of Applied Life Sciences (one of the Claremont Colleges) offers a “Professional Master’s in Biosciences (MBS) Degree”. This is the only similar program offered on the west coast of which we are aware. Other west coast “professional master’s programs” are further removed from the SJSU MBT curriculum. They include programs which fuse: computation and all sciences (San Diego State University), computational molecular biology and bioinformatics (University of California – Santa Cruz and University of Southern California), biology and bioengineering (Oregon State University), environmental science and technology (USC), environmental science and government (OSU), and physics for business applications (USC and OSU).

Plans for the Next Five Years

• Maintain full enrollment at current levels (two classes of 18 students)
• Provide faculty members who teach in the program with an opportunity to work with industry experts to acquire additional expertise and industry knowledge appropriate for the MBT program.
• Expand graduate course offerings to enable MBT students to take more of their electives in the Department.
• Continue to track student outcomes and adjust program accordingly.
BS Biological Science, Concentration in Molecular Biology.

<table>
<thead>
<tr>
<th>Course Requirements</th>
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<tr>
<td><strong>General Education Requirements</strong></td>
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</tr>
<tr>
<td>Of the 51 units required by the university, 12 may be satisfied by specified major and support requirements. Consult major advisor for details.</td>
<td></td>
</tr>
<tr>
<td><strong>American Institutions</strong></td>
<td>(6)</td>
</tr>
<tr>
<td>Of the 6 units required by the university, all may be satisfied within general education requirements as specified in the schedule of classes.</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Education</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Preparation for the Major</strong></td>
<td>20-22</td>
</tr>
<tr>
<td>PHYS 002A and PHYS 002B (8); MATH 030P or other calculus (3-5); BIOL 005 and BIOL 155 (6); BIOL 100W (3)</td>
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<tr>
<td><strong>Requirements in the Major</strong></td>
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<tr>
<td>BIOL 001, BIOL 002, BIOL 003, BIOL 004, BIOL 006, BIOL 107, BIOL 115, BIOL 116, BIOL 135 and BIOL 135L (30); MICR 101 (4); Complete twelve units from: BIOL 105, BIOL 116L, BIOL 117, BIOL 124, BIOL 125, BIOL 137, BIOL 205, BOT 102, MICR 170, or other courses with prior advisor approval (at least 8 elective units must be in Biological Sciences) (12)</td>
<td></td>
</tr>
<tr>
<td><strong>Requirements in the Minor</strong></td>
<td>23</td>
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<tr>
<td>CHEM 001A, CHEM 001B, CHEM 112A, CHEM 112B, CHEM 113A, CHEM 120S and CHEM 135</td>
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<tr>
<td><strong>Electives</strong></td>
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<tr>
<td><strong>Total Units:</strong></td>
<td>132</td>
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</table>

A. Centrality to the Mission. Mission and Goals of the Program.

The mission of the BS Biological Sciences Concentration in Molecular Biology is embraces providing students with both a working knowledge of the practical and theoretical aspects of the discipline and a command of the loftier and more empowering universal skills associated with a truly educated person. As to the former, the concentration seeks to prepare its majors for employment or graduate work in any field requiring an in-depth understanding of molecular and biochemical processes at the cellular level, e.g., biotechnology, genetics, cell biology, physiology and health sciences, toxicology, forensics, microbiology, developmental biology – in short, any field requiring an understanding of how cells initiate and maintain metabolism and cell structure, how they carry out specific cell functions, drive and orchestrate specific gene expression patterns, how they replicate and/or how they select among various differentiation pathways. In support of this goal, the program seeks to provide all students with a solid background in the basic biological, biochemical and physical sciences. Added upon this are courses in general and advanced (molecular) genetics, immunology, biostatistics, microbiology, with laboratory experience that includes the isolation and manipulation of molecular and subcellular components (organelles, nucleic acids, proteins etc.), the measurement, characterization and analysis of such components (via UV and visible light spectrophotometry, brightfield, phase and fluorescence microscopy, agarose and polyacrylamide gel electrophoresis, PCR, restrictions, ligations and sequencing, radioisotopic labeling and liquid scintillation counting, among other techniques), the
isolation, culturing and manipulation of both prokaryotic and eukaryotic cell lines and strains, small animal handling and immunization, the construction and selection of recombinant organisms etc. In addition, all students are expected to pursue specific interest areas within the broad discipline of cellular and molecular biology (choosing from course selections in bioinformatics, developmental biology, virology, systems physiology, microbial pathology etc).

The latter goal, the command of the universal skills of education, is our second critical mission. These tools involve the development of advanced reasoning skills (intuitive, conceptual, logical and analytical reasoning), a command of both qualitative and quantitative problem solving skills (ideally accomplished in real-time lab, field or conference settings), and the ability to work independently – to obtain the information needed through their own creative and/or intellectual devices, and then put it to work to accomplish their goals. These universal tools also involve, and in fact require, a command of oral and written communication skills, the self-confidence to use them, and the wisdom to employ them constructively. They require both scientific literacy – the ability to read, understand and critically analyze the biological scientific literature – and, no less importantly, the ability to work productively within a group, yet to think beyond its bounds. To help accomplish these goals the Department of Biology seeks to provide both students and faculty with modern, well-equipped laboratories and classrooms, high-speed internet access, a faculty research program involving both graduates and undergraduates, and a stimulating intellectual environment conducive to effective teaching, learning, productive research and scholarship.

To facilitate accomplishment of the goals stated above, we are now considering several changes to the BS Biological Sciences, Concentration in Molecular Biology program:

1. Make a formal course in bioinformatics (e.g. Bio 121) a requirement in the major.
2. Require that students in the major select at least one of the following as an elective: (a) Developmental Biology (e.g. Bio 105), (b) Virology (e.g. Micro 170), (c) Human Genetics (Bio. 117) or (d) Mammalian Physiology (Bio. 124).
3. Strongly encourage all undergrads in the major to take a year long biochemistry course with at least one semester of lab (e.g. Chem. 130A, 130B and 131A). Any prerequisites to these courses would, of course, be the responsibility of the student to fulfill. Work with the Chemistry Department to strengthen biochemistry offerings.
4. Integrate both principles and examples of quantitative chemistry into courses in the program.
5. Integrate the concepts of classical genetics, molecular genetics and bioinformatics into courses in the program.
6. Strongly encourage research experience for all undergrads in the major, but make a research project and formal written senior thesis (detailing the biological context of the problem addressed, the materials and methods, results and conclusions derived from the work) a requirement for those students wanting to graduate with honors in the major. In addition to a minimum GPA of 3.15 in the major (i.e. a "B/B+" average) both at the time of application to the Honors program and at the time of graduation, a formal written research proposal must be submitted to both the department and a sponsoring faculty member no later than the start of their senior
year in the program. Lab work must be initiated, upon acceptance into the honors track, no later than the start of the second semester of their senior year in the program. Acceptance into the honors track would require written acceptance of the student and their associated project proposal both by the department and by a sponsoring faculty member serving as that student's senior thesis advisor. Acceptance of the student's senior thesis as complete and satisfactory both by the sponsoring faculty member and the Biology Department would be a requirement for graduation with honors. In recognition of the intrinsic value of such effort both to students in the BS Molecular Biology concentration and to the department in general, it is proposed that the department would commit funds (approximately $500 per accepted student) for the purchase of reagents and supplies to at least partially offset the cost of each project.

Program Contributions to the Mission of SJSU.

The Molecular Biology concentration as currently outlined provides its students with the fundamental intellectual skills and theoretical and practical knowledge required for a successful career as a molecular biologist. It provides them not only with a broad-based understanding of the discipline of molecular biology, but also a working knowledge of science (the logic and conceptual framework from which it arises) and the scientific process in general. Throughout their tenure in the program, students will also have the opportunity to examine the interplay of societal preferences, logic and ethics when addressing such issues as the development or use of embryonic stem cells, the generation of new, chimeric or recombinant proteins for therapeutic uses, the creation of genetically modified plants and foods, the generation of novel viral systems for use in gene therapy etc. The ever-expanding applications of science demand examination by well educated and prepared minds, and in this sense the program serves a vital, in fact critical, societal need.

B. Quality of the Instructional Program.

The molecular biology area endeavors to provide quality instruction by having tenured/tenure-track faculty personally provide the instruction of all lecture and laboratory courses in the area. Faculty in molecular biology interact personally with each student in every lab section, personally read each students laboratory notebook, grade all exams, problems sets, term papers, host all office hours, etc. The faculty strive to incorporate, both in lecture and laboratory settings, the latest information from the current professional literature, and take pride in the time and effort they extend on behalf of their students. The teaching technique and quality of faculty are regularly assessed both by students (via SOTE and SOLATE forms) and by other faculty members (via detailed written reviews), and the resulting evaluations (scores) are typically above SJSU's average. In short, the Department has a strong commitment to excellence in teaching. One faculty member in the program even received the SJSU Outstanding Professor Award for 1998/99. Feedback from former students about the quality of our program, and from biotech employers about the preparation of our students in the molecular biology concentration, is outstanding. See Appendix 18.

Molecular biology is, however, an extremely dynamic discipline, incorporating an ever-expanding collection of techniques and applications from biochemistry, immunology, virology, microbiology, cell biology, genetics, bioinformatics etc. The
field demands vigilant review and constant updating of equipment, laboratory exercises and applications and theory-based lecture material if the program is to remain current and relevant. Fortunately, the Department of Biology at SJSU has committed itself to this endeavor.

The Molecular Biology Program assesses its curriculum and the students in the program using a variety of measures, from writing samples and observations of group work and laboratory work, to exams such as the ETS’s Major Field Test in Biology and our own Molecular Biology Assessment Test. Though we are in the early phases of implementation of these assessments of our student learning objectives, we have established a baseline and some pilot data that will give an idea of where we are going with this. See Appendices 7, 8, 9, 11, and 13.

C. Student Demand.

By the end of this academic year the BS Molecular Biology program will have more than doubled over the past 5 years. Besides the defunct BS General Biology program, the Molecular Biology concentration has over that same 5 year period been the most heavily enrolled BS concentration in the department, and has continually graduated more students than any other BS concentration. With the current and projected need for molecular biologists in biotechnology and allied medical sciences, we expect the number of majors to grow or, at a minimum, remain stable.

Students in the program are fully aware of both the need for molecular biologists in recombinant virus construction (for vaccine development, cloning and expression studies and gene therapy applications), the development of recombinant protein expression systems (for industrial, medical and veterinary applications), gene and genome mapping and characterization efforts etc, and the dynamic nature (and thus job volatility) associated with those technologies. They understand the importance of keeping current in both the technological (practical) and theoretical arenas, and simultaneously recognize both the growing international competition among biotech companies and the ease with which offshoring of biotech jobs can occur. Our students demand, and in fact deserve, the best we can provide in terms of breadth in course offerings, depth and relevance of course content, and currency of content. Their careers and their economic viability depend upon it.

D. Societal Need.

The biotechnology industry requires people trained in bioinformatics, genetics, cloning and expression vector construction, nucleic acid and protein purification and characterization, cell culture, signal transduction pathway discovery and characterization, antibody production, vaccine development etc. That these skills are required in our modern technological society is unarguable.

E. Financial Resources, Viability and Efficiency.

The Department of Biology has historically been the primary source of instructional funds for the molecular biology program. Like courses in the microbiology concentration, molecular biology laboratories are extremely labor-intensive to design, optimize, set up and run, requiring separate microbiology and molecular biology service centers staffed by full time instructional support technicians (one and three technicians,
respectively) and at least one instructional support technician. All culture media, microbial cultures, mammalian cell cultures, and phage and animal virus stocks are purchased from departmental funds and/or maintained at department expense. While sporadic donations from local biotechnology companies have supplemented equipment and supplies in the past, such donations are rarely large enough or complete enough to fully support even a single course. NSF, lottery and private grants typically support faculty research efforts, but rarely are big enough to support large teaching labs.

As far as teaching equipment goes, the Department has some bright spots and some obvious deficiencies. Three fluorescent microscopes are now available for instruction and research applications, and heavy use is made of these instruments in the molecular biology and microbiology teaching labs. Unfortunately, these microscopes are not yet fitted with low light/CCD cameras (or any cameras, for that matter), so that students cannot currently create a photographic record of their experimental results using these microscopes. While labs have access to thermal cyclers, power sources and gel boxes for standard PCR work, the Department does not possess any real time PCR (thermal cycler) instrument, making many experiments involving analysis of gene expression impractical. Similarly, we still lack any microarrayer or chip reader instrumentation, again making the training of our students in this critical area of biotechnology impossible. While we have a number of microfuges for our teaching labs, many are very old and near the end of their functional lifespan, and none are refrigerated. Two of our three refrigerated high speed centrifuges are nearly 40 years old and parts are now unavailable for them, yet the instruments are used heavily in both molecular biology and microbiology teaching labs (and for research purposes). Replacement of even one such instrument would represent a very significant financial outlay for the Department. While the Department has made a significant investment in UV/Vis spectrophotometers over the past 6-7 years, we still often run teaching labs on one or two instruments short, forcing us to send students to a different room (a common equipment room) to use the two instruments housed there (even though those instruments are of a different make and require different protocols for use). Two of our four aging autoclaves have been replaced, but heavy research use is still made of the remaining two old ones. At a cost of over $40,000 each replacing an autoclave can consume nearly half of the Department’s budget.

Our scanning electron microscope was in such disrepair and the cost of replacement so high that the instrument was scrapped and a course taught for over 15 years in the Department (Scanning Electron Microscopy, Bio. 240) terminated. Our transmission electron microscope is also currently in need of repair (and a maintenance contract), and if financial support for that instrument not found soon our Cellular Ultrastructure course (Bio. 234) may suffer the same fate as Bio. 240. Our single channel capillary DNA sequencer is itself something of a relic, parts are difficult or impossible to obtain, and the instrument currently has no technician to maintain it. While the Department does possess a very workable cell culture teaching lab with multiple laminar flow air hoods, support for courses involving a significant amount of mammalian cell culture (a important component in any biotechnology-oriented program) will become even harder as seasoned technicians (who do most of the routine cell culture and expansion for our courses) retire and/or their positions terminated. Without adequate technician support, maintaining our current course offering involving mammalian cell
culture (let alone developing new courses involving embryonic stem cells, cell bioreactors, fermentors, FPLC and/or HPLC purification of culture-generated proteins etc) will be extremely difficult. As stated above, there are some bright spots in this picture, but a number of significant problems as well.

A survey of current faculty who teach in the area reveals that up to four are likely to enter retirement in the next five years (including Fowler, Rodriguez & Brinegar). Each of these members of the Area teach critical courses for the program: General genetics, human genetics, and advanced seminar in genetics; toxicology, radiation biology, graduate studies in biology; cell biology, advanced molecular techniques. This, in addition, to the expansion of demand for instruction in the BS concentration in molecular biology, MS concentration in molecular and microbiology, and the MBT program, and an expansion of our bioinformatics program from one course to five courses (121, 123A, 123B, 221, 221T) over the last five years makes faculty hiring in the area essential.

We already have requested permission to recruit an immunologist to replace the one who is currently in the Faculty Early Retirement Program and teaching a half load. We also will need to hire a bioinformaticist/geneticist and a molecular cell biologist in the next five years. The program would be materially weakened if these hires do not anticipate the retirements and enrollment growth in the program.

Finally, but not least important, is the issue of research space. We have had an increase in the number of faculty with active laboratory-based research programs and have had a commensurate increase in difficulty finding space for our new hires. This is an significant problem and needs to be addressed systematically in the coming years.

F. Interdependence of the Program

Introductory Cell Biology (Bio. 3), taught by faculty in the program, serves essentially all biology majors, as well as biochemistry majors and all those seeking entrance into medical/dental/veterinary/pharmacy schools. General genetics (Bio. 115) also serves other majors beyond biology, especially biochemistry. Many students in the BS Biological Sciences, Physiology program and virtually all MS Biological Sciences, Molecular Biology students take Bio 135 and Bio 135L (molecular cell biology and lab). Faculty in the program also teach in the MBT program (Bio 205T and Bio 221T). The BS Molecular Biology program is integral to the Biology Department.

G. Capacity to Contribute to an Academic Field.

Almost all the faculty teaching in the program have active research programs involving students and culminating in theses and often publication. While the lab-intensive teaching load and particularly high demands of molecular cell biology journals for quantity of work required for publication can be great, program faculty regularly make scholarly contributions to the field.

H. Availability of Instructional Alternatives.

SFSU and CSU East Bay both offer undergraduate programs in molecular biology. Ours is particularly strong given its laboratory requirements (microbiology, immunology, bioinformatics, cell biology), its array of genetics offerings (general, molecular, human, population, and sometimes neuro- and cancer genetics are all offered in addition to graduate genetics courses). Tenured/tenure-track faculty also teach most of our courses.
in the program, giving continuity, commitment, and expertise to the instruction students receive. Our molecular biology program is reputed to be one of the strongest in the CSU system.
<table>
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<td># Required Class Meeting Objective</td>
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<tr>
<td>17 units</td>
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Instructor(s)
A: Centrality to the Mission

Mission and Goals of the Program

The Anatomy and Physiology area offers students one BS concentration: Systems Physiology. The goal of this program is to provide a strong and rigorous academic base in fundamental animal physiology that prepares students who are interested in seeking advanced degree programs (M.S. and Ph.D.) in physiology, and for careers in biotechnology, biomedical health fields and in teaching. This program has a long history of consistent student enrollment and its upper division course offerings attract undergraduate and graduate students interested in applying to medical, dental and pharmacy programs as well as to physician’s assistant programs, podiatry and chiropractic schools. A small number of students continue into Masters or Ph.D. degree programs or into research and technical positions in biotechnology and pharmaceutical companies. Our majors are required to take a general upper division physiology course (Mammalian Physiology) and two other courses (Endocrinology and Vertebrate Neurophiology) that provide depth with respect to the two organ systems that integrate and coordinate physiological functions. The Mammalian Physiology Laboratory course and others provide a particularly strong laboratory experience to support and augment the information provided in lectures. The technical expertise afforded our students is the hallmark of the Systems Physiology experience at SJSU. This effort requires a strong commitment to periodic instrumentation upgrades and the incorporation of new technologies into the curriculum.
Program Contributions to the Mission of SJSU

This program has made a long-standing contribution to the fulfillment of the University’s mission statement through its students’ successes and its faculty research and scholarship. The breadth and rigor of coursework provides our students with a depth of knowledge and an expertise of skills that make them extremely competitive as competent health care workers, teachers, biotechnology industry employees and research scientists. Each of these career choices has become more reliant upon technology. As a result, the Area has sought to keep its students abreast of the latest developments in data acquisition, analysis and presentation. Most importantly we provide students with both the time and instrumentation to hone their skills. Research scholarships are made available by the department to students in this area with interests beyond the classroom. This allows them to extend the already substantial time spent in regular class laboratories to work in faculty research labs. In addition, courses within the program require that students write and speak before a group so that they develop the interpersonal and communication skills necessary for success in their careers. Students in the program are given the knowledge and skills to be successful in their chosen fields, to contribute substantially to the welfare of society and to become active and informed citizens.

B: Quality of the Instructional Program

Figure 1: Undergraduate Courses Taught by Anatomy and Physiology Faculty

<table>
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<tr>
<th>University Service</th>
<th>Service to Other Departments</th>
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<td>BIOL 65 Human Anatomy</td>
<td>BIOL 124 Mammalian Physiology</td>
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<td>BIOL 54 Human Understanding and Development</td>
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<td>BIOL 109 Human Neurophysiology and Neuroanatomy</td>
<td>BIOL 126 Vertebrate Physiology Lab</td>
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<td>BIOL 196A Physiology for Engineers</td>
<td>BIOL 131 Endocrinology</td>
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Quality of Instruction

The area provides courses in all the major subdisciplines of anatomy and physiology. The quality of instruction is strong. SOTE and SOLATE scores are at or above the University Average. Three faculty members in this program have been acknowledged as outstanding teachers by the Disability Resource Center, one has been a Teacher Scholar, and three have been awarded ITL Innovative Teaching Grants or Champion’s Grants. Faculty are well aware of trends in their field and in industry. As a result, the Area seeks to provide educational
experiences relevant to a rapidly changing workplace where advances are most often made at the interface between disciplines. For instance, the area has recently developed a course in collaboration with faculty in Chemical and Materials Engineering. The objective of this course (Physiology for Engineers) is to provide a link between the current understanding of physiological systems in health and disease and the development and practical application of innovative technologies to monitor, repair, replace or augment those systems. Students in this course include SJSU graduate students and practicing engineers in the field. Although not intended for our majors, this course has already influenced the content of several undergraduate courses.

Recently the area has expanded its list of approved electives to broaden the perspective of its students. In particular, systems physiology majors may now take additional coursework in genetics so that they might take better advantage of the powerful research toolset developed by the latest advances in molecular genetics. These students would be well-positioned to successfully compete for employment in the biotechnology and pharmaceutical industries.

Faculty members not only present lectures but also participate in teaching 1 or 2 sections of Physiology laboratory and up to 4 to 6 sections in Anatomy laboratory classes. Carefully selected graduate students who are rigorously trained and closely supervised may teach other sections. The quality of teaching in the physiology laboratories is further improved by regularly scheduling rehearsals of each lab activity the week before the actual labs are given. These rehearsed lab exercises are completed with all instructors, assistants and support staff present. This quality control has made our labs more effective as teaching tools by reducing confusion and preventing mishaps. In addition, each semester outstanding undergraduates with proven laboratory skills are invited to participate in the physiology labs as tutor assistants (Biol 182). Such assistants are often more effective than instructors when trying to communicate with and support the more challenged students. This experience also affords the tutor a chance to review information and to hone their communication skills.

**Overall Indicators of Program Quality**

There are several indicators of the quality of our program: 1) increased student demand, 2) student success and 3) recognition by other departments across campus. The number of students in the systems physiology major has increased because of the continued interest in the careers for which we prepare students and because an increased number of 2nd baccalaureate students have recognized the quality of our program. (See C: Student Demand below). In addition, the increased availability of jobs in nursing, occupational therapy, and teaching have put pressure upon our service courses to expand their enrollments. A final testament to the quality of the program is that although instructional alternatives to our service courses exist elsewhere, the BS programs in Nursing and Occupational Therapy strongly encourage their students to fulfill prerequisites by enrolling in our courses.

The area is participating in the Department’s unified assessment plan, assessing students for many different learning outcomes from writing to group work and laboratory skills to content knowledge in systems physiology. Toward this end, we have begun to assess students in Bio 4 (lower division students mostly) and will soon assess graduating seniors in Bio 144, with two instruments: the Educational Testing Service’s Major Field Test in Biology (see Appendix 11) and our own program-specific systems physiology assessment test (see Appendix 15).
Challenges to Program Quality

The Area has served the needs of students well by providing a quality educational experience. However, there are three ongoing challenges to this quality: 1) sufficient faculty recruitment, 2) periodic replacement and upgrades of instrumentation and 3) expansion of existing facilities to meet enrollment demands. The significant increase in the number of students and the concomitant reduction in A&P faculty are at the core of each of these challenges. The demands of increased enrollment are most keenly felt in our anatomy and physiology service courses. The loss of faculty to retirement, administration and consulting outside of the university are the source of our current predicament. As a result of this situation, the Area has contracted and it has been difficult to adequately respond to current staffing demands. The area has not hired new tenure-track faculty in over 14 years while several area faculty have retired or begun teaching outside the area, and enrollments have risen dramatically.

The second challenge to quality is an ongoing issue. The Area must acquire the resources to perform replacement and periodic upgrades of its teaching and research laboratory instrumentation. The heavy use that follows increased enrollment necessitates a faster rate of replacement. Information concerning the purchase of specific instrumentation is derived from the experiences of faculty in their research labs and that of students in the workplace. For instance, recent, significant developments in imaging technologies utilized by our students on the job, such as confocal microscopy, warrant the area’s attention. Acquisition of sufficient funds to provide state-of-the-art instrumentation in this regard will most certainly require extramural funding sources.

The third challenge is also tied to increased enrollment. In the spring of 2005 enrollment in our service physiology courses increased to 15 lab sections. Our facilities are operating at their maximum capacity and yet we are turning students away. Accommodating these students will require additional space or remodeling of currently held space. Both of these are expensive propositions and extramural funding sources will need to be identified to address this issue.

Future Plans

The Area has asked and received permission from the department to plan for the search and hiring of one additional faculty member in the current academic year (05-06). This person’s major focus will be in the two heavily in-demand service courses: Human Anatomy and Human Physiology. The successful candidate will also be expected to participate in the majors’ physiology course (Mammalian Physiology) and to develop an undergraduate or graduate level course in their field of expertise. On possible plan would be to hire an ecological physiologist. Such an individual would provide a potential collaborative research link with faculty in the Organismal and Evolution Area.

Instrumentation replacement and upgrades are likely to be a focus of extramural grant applications in the coming years. Facility expansion and/or renovation will require major funding. Nevertheless, plans for this should be a topic for Area discussion.
C: Student Demand

The area offers an array of courses in the major, as service to other departments and colleges and to the university at large in the form of general education courses. The numbers of students completing the degree in Systems Physiology has remained relatively unchanged over the past 10 years (10-14 per year). In contrast, the numbers of students identifying themselves as physiology majors has increased dramatically (Figure 2). Interestingly, student career

![Figure 2: Enrollment trends for Systems Physiology](image)

objectives have shifted within the health field as 1) competition for positions in medical schools has grown more intense, and 2) the controversy concerning health maintenance organizations (HMOs) and their effect upon the administration of effective medical care continues to intensify. As a result, students have sought various alternative opportunities, which include physician's assistant programs as well as positions in biotechnology and pharmaceutical companies. In addition to this increase, in recent semesters there has been a marked increase in the number of 2nd baccalaureate students within the area. The majority of these students are seeking to acquire the prerequisite courses for application to professional schools and additional intensive instruction in preparation for professional school entrance exams. Student demand for the Area service courses has increased dramatically in the past few years. Human Anatomy is taught in both Fall and Spring Semesters and enrolls 400-500 students. Human Physiology is taught in the spring semester and this year in the summer as well. It now enrolls 300-400 students. General education (GE) courses in the area have also expanded. The GE expansion, however, is actually much smaller than anticipated because of changes in the criteria of course acceptance in the GE life science category.

The increased demand also reflects, in part, the increased numbers of students who are interested in teaching life sciences at the K-12 level. The demand for such individuals is expected to increase enormously as both the federal and state government put emphasis on improving the quality of public education.

The graph shown below depicts the relative proportion of courses and the total number students taught in the last four academic years. The information for academic year 05-06 includes only data for the current fall semester.
Figure 3: Enrollment trends in Anatomy and Physiology courses. Note the large increase in enrollment in service courses (only one semester of data was available for 2005).

In the fall of 2004, the department opened up newly constructed anatomy labs. These state-of-the-art facilities have allowed the department to increase enrollment per lab section without any detrimental effect on teaching effectiveness. In fact, active student participation in labs and student performance as measured on examinations, have increased.

D: Societal Need for the Program
The local community, county and state benefit greatly from this program as we contribute to meet the needs for the growing demand for health care providers and K-12 science teachers. Graduating students enter the ranks of this community at diverse levels and in a multitude of capacities. For example, the Systems Physiology program provides a wide range of physiology courses for undergraduate (and graduate) students in nursing, occupational therapy, human performance and nutrition. The Area provides these students with an experience in human anatomy by offering an introductory course (Biology 65) and an advanced course for our majors (Biology 165). San Jose State University is unique in this respect. The growing biotechnology and pharmaceutical industries benefit from the skill set our students acquire. In particular our systems physiology program at SJSU is unique in the nation in its providing students the invaluable experience of handling a variety of animals and learning the complexities of small animal surgery.

E: Financial Resources, viability, and efficiency
Sources of Program Funding
Courses are funded by the department’s budget. Funding for course improvements in teaching and technology has come primarily from state lottery sources. This source of funding is often small and unreliable for necessary and consistent instrumentation upgrades needed in our course labs. Multi-year funding for faculty research has been derived from such sources as NASA and the MARC (Minorities Access to Research Careers) and the MBRS (Minorities in Biomedical Research Support) Programs under the direction of the Institute for General Medical Sciences of the National Institutes for Health (NIH). Another source of funding is the laboratory fees paid by students each semester. The amount of fees collected has increased along with enrollments in A&P courses during the past five years. Anatomy labs have traditionally charged
a $10 fee per semester, while physiology labs have charged $25. This difference reflects the relative expenditures to keep these courses running. These funds are pooled across the department and decisions regarding allocation are made by the chair in consultation with faculty and staff.

**Analysis of Resource Stability and Impacts on Program Effectiveness**

Recent developments in technologies to collect, analyze and present physiological information require regular upgrades in equipment. In particular, recent advances in electrophysiological instrumentation and new imaging technologies including various forms of microscopy would enhance and extend our ability to continue to provide a strong laboratory experience for our students. Decreased sources of funds, due to a decrease in the college’s FTES, and reduced numbers of tenure-track faculty threaten this Area’s long-standing success.

**Program Plan**

Two items stand out for attention with regards to resources. The first is the requirement to replace faculty that are lost to retirement and who have received reassigned time because of research grants or to other duties within the university. While temporary faculty help to fill the gap in the classroom, the loss of tenured and tenure-track faculty is keenly felt and their expertise and strong efforts on our students’ behalf are sorely missed as the Area experiences the demands of increasing enrollment in the major and in our service courses. The second need is for funds to upgrade the instrumentation in our labs. So that we might educate our students with the latest instrumentation, the area needs to be aware of what skills students need to have when they enter the workplace. In the past year the departmental equipment budget has been used to purchase new instrumentation for its heavily utilized physiology labs in the service course (Biology 66). Now that this course is taught in the spring (15 lab sections) and the summer (4 lab sections), the constant wear and tear on equipment is much increased. This new equipment replaces only a portion of that used in the course and does not replace that in our majors’ physiology lab. The department regularly receives consumables and some instrumentation for local industry. This source needs to be investigated with respect to the needs of the Area.

One faculty member spent considerable effort to acquire funding through private sources to construct the first phase of the department’s new anatomy facility. While this facility is now operational, additional funds must be sought to completely realize the original plan. Finally, the Area needs to be consistent in its efforts and innovative in attempts to pursue other avenues to obtain funding to replace equipment and facilities where necessary.

**F: Interdependence of Programs**

Several courses offered by the Area satisfy requirements in BA Biology and other BS degrees offered by the department. For instance, Mammalian or Vertebrate Physiology (Biology 124/125/126) satisfies the departmental requirement for an upper division physiology course in some of the BS concentrations and in the BA Biology. Endocrinology (Biology 131), Histology (Biology 134), Neurophysiology (Biology 136), Toxicology (Biology 137), and Advanced Human Anatomy (Biology 165) fulfill upper division elective requirements for the BA Biology. Mammalian Physiology (Biology 124) may satisfy upper division elective credit in the Biochemistry programs of the Chemistry Department (BA and BS). The Area also provides two General Education courses (Biology 21, 54), which serve students across the university in the
Core GE Area. Finally, the Area provides service courses in Anatomy and Physiology (Biology 65, 66, and 109) to other departments across campus including Nursing, Occupational Therapy, Nutrition and Food Science, Psychology, and Human Performance.

G: Capacity to Contribute to an Academic Field
Several faculty members within the Anatomy and Physiology program area have obtained extramural funding and some have recently published original research (See Table below). Some have long-standing track records of publication in their discipline and have established collaborations with such entities as NASA Ames Research Facility in Mountain View and U.C. Berkeley. Undergraduates benefit directly from faculty research efforts that are, in part, supported by the MARC and MBRS programs. Faculty members regularly enroll students for units in research, hire them as lab assistants, and mentor them in informal research-oriented journal clubs. Undergraduates have been given the opportunity to collaborate in published research and to present at scientific meetings at the local, state and national levels.

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Figure 4. Anatomy and Physiology Activity, 2000-2005

Faculty continue to be active in their research and scholarship. Efforts to identify sources of and acquire extramural funds for existing research are ongoing. And collaborations within the university and with others in industry, government agencies and other universities are also ongoing. Note that faculty in this Area have submitted 11 grant proposals in the last five years and that substantial funds have been awarded. In addition, faculty continue to improve mentoring of students at both the undergraduate and graduate levels by providing out of the classroom experiences in their own research labs.

H: Availability of Instructional Alternatives
No other program in the South Bay provides a similarly strong program in Systems Physiology for its biology majors. Stanford and the University of California campuses at Berkeley and Santa Cruz provide strong coursework in lecture classes but lack intensive laboratory experience unless undergraduates find their way into a faculty member’s personal research lab. Our graduate students and post-baccalaureate students, coming from these campuses, attest to this situation and are impressed by the breadth and rigor of our upper division
laboratory classes. Nearby CSU East Bay and University of Santa Clara provide more modest offerings to their smaller student enrollments. With respect to service courses for other majors such as nursing and occupational therapy, the pool of prospective students in the area is large and more than sufficient to supply a number of equivalent courses at various institutions. Still, the BS programs in Nursing and Occupational Therapy at SJSU encourage their applicants to take their preparatory training in our Area’s service courses.

Section Five: Program Plan for the Future

A. Summary Statement of Program Strengths, Challenges and Opportunities

The Anatomy and Physiology Area prepares its students well for their professional careers, public lives as active, informed citizens and personal lives as life-long learners. The courses are diverse, challenging, rewarding, and instill in the students a passion for knowledge and wisdom. The challenge is not to maintain the status quo but to improve our offerings in the face of growing student needs. It is not likely that we will be able to expand those offerings due to recent changes in the structure of our faculty. Future hires must be used to continue the breadth of courses offered and to make those courses relevant to students when they leave us to confront educational and employment challenges in the world outside the university.

B. Planned Direction of Program for the Last Five Years

The program of coursework in the area has been maintained in the last five years. Contraction in the number of faculty has been met by a reassignment of members from other duties, such as general education instruction, to the core area courses. The increased population of graduate students in the Area has also been utilized as a source for instructors in laboratory sections. Several courses, including Human Anatomy (Biology 65), Advanced Human Anatomy (Biology 165) and Human Physiology (Biology 66), are experiencing an increased demand. This trend is expected to continue and demand further faculty and graduate student shifts to meet the needs of undergraduate students.

C. Assessment

1. Program Goals

b) to give students the skills, experiences, and content that prepare them for careers or advanced study in biology or related fields.

c) to help students develop the skills and the desire necessary to become life-long learners.

d) to provide students with sufficient background to contribute to the scientific and societal arenas.

e) to graduate students who hold themselves to the ethical standards that are consistent with the expectations of a university education.

f) to provide an environment that allows students to experience the joy of scientific discovery and the value of learning.
x) provide a rigorous academic base in animal physiology that prepares students who are interested in seeking advanced degree programs (MS and Ph.D.) in physiology, and for careers in biotechnology, in biomedical health fields and in teaching.

2. Performance Outcomes for Majors

A) to develop a foundation of biological knowledge and laboratory skills
B) to develop critical thinking and problem solving skills
C) to work effectively individually and in groups
D) to develop strong oral and written communication skills
E) to develop fundamental quantitative, computer and information literacy
F) to develop an appreciation for and understanding of the role and impact of biology on society.
S) have an in-depth understanding of animal physiology

Generally our faculty tend to be very progressive in terms of experimenting with teaching and assessment strategies. Since no new resources are available to do assessment in the major, our strategy is heavily dependent on assessment techniques that faculty use during the normal course of instruction. Our plan for assessment is to work with the department overall to assess common learning objectives and to use the Educational Testing Service’s Major Field Test in Biology and our own Systems Physiology Assessment test to track how effectively our students are achieving the learning objectives we have for them and to use this data to guide changes in our curriculum. See Appendix 11 and 15.
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Table: BS Biological Science, Systems Physiology
BS Biological Sciences, Concentration in Conservation & Organismal Biology

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<th>Course Requirements</th>
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<td><strong>General Education Requirements</strong></td>
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**Section A: Centrality to Mission**

This undergraduate concentration includes the traditional organismal disciplines of zoology, botany, and entomology as well as conservation biology as emphases. These disciplines, along with microbiology, were once the focus of the biological sciences and still might be argued to be the cornerstones of modern biology. The subject matter of these areas concerns the description and classification of the wide breadth of organisms on the planet. This information made possible the genetic and biochemical discoveries that so occupy current biology departments, including our own. It also provided a control
mechanism for genetic manipulation, where genotypic changes could be understood only in the context of the whole, unmodified organism. It has been, and continues to be, a tradition in the Biology Department to require students to gain knowledge in all aspects of biology and to be able to relate molecular information to the whole organism. The organismal and conservation courses, therefore, remain vital. Our goal is to educate students on the anatomy, morphology, and other structural features, the physiology and other functional features, the classification and evolutionary history of and pressures (taxonomy and systematics) on groups of organisms on earth, including plants (botany), animals (zoology), and insects (entomology). We further wish to educate on the interactions within and between these groups of organisms as well as their interaction with abiotic factors in their surroundings (ecology). We wish to teach our students the value of these organisms, in terms of human exploitation of them to some extent but also in terms of their intrinsic interest and role in ecosystem processes (conservation).

We have preserved this critical biological concentration because it affords the attributes embodied in the university’s mission statement. The lives of the students who choose this concentration are enriched in several ways. Most vitally, students gain an appreciation for and understanding of their own place in the natural world and the role of biology in their lives. This self-awareness allows them to appreciate the earth’s biodiversity, broadening their perspective to recognize the effect and dependence of global economies on species’ survival and well being. Evolutionary pressures and reproductive strategies are better understood, leading to a recognition of the need for global conservation. In expanding these perspectives and attitudes, our students’ knowledge base is, of course, expanded in tandem. As is true of the rest of the department’s offerings, we in the organismal area pride ourselves on the high quality of resources made available to the undergraduate student in our program. Hands-on training and experience with techniques and instrumentation of a classical and more recent vintage are constants in this area as well as in the department as a whole. Thus students in undergraduate classes gain skills in laboratory and field techniques at a research level. In addition, many of our organismal-oriented students work in faculty or off-campus research labs to better hone these skills. Research scholarships are made available by the department to students with interests beyond the classroom. More general kinds of skills and knowledge are also emphasized in the courses in this area. There is probably a greater emphasis on writing and speaking skill acquisition in this concentration than in the others. Many of the courses include independent projects that culminate in written and oral presentations to the class. Computer skills, statistical analyses, and other quantitative tools are key, especially in the taxonomic and ecological courses. This area also assigns prominence to general problem solving, including design and interpretation of scientific problems, which require extensive training and resourcefulness to conduct. When students have completed our program, they and our community benefit. They are transformed into more informed voters, a function that is increasingly concerned with scientific matters from bioengineered food to reproductive issues to stem cell research. These students become professionals in the private and public sector. Many use their undergraduate experience as preparation for graduate school, a requirement for many positions in teaching, conservation biology, and marine biology.
Section B: Quality of the instructional program

We believe the quality of instruction in this concentration to be very good. The courses embrace a relatively wide breadth of subjects, so that a kind of piecemeal education within a broad discipline is avoided. A high percentage of classes in this concentration include a laboratory component and often two labs per week. The labs are taught almost exclusively by faculty members rather than by teaching assistants, so students derive the benefit of more expert instruction. The faculty members have specialties but over a range that allows them to teach several upper division courses within an emphasis. They embody a variety of specialties, of course, but are matched in their teaching to their individual specialty. SOTE and SOLATE scores of the faculty have been high. On the downside, some of our emphases contain gaps owing to lack of replacement of retiring faculty members. Along with traditionally low enrollments, this scenario will continue to be exacerbated and will represent the key limitation in the area and concentration. The quality of individual courses has and will likely continue to remain high in these cases, while the comprehensiveness of the program as a whole will suffer. Course and program diversity is both a strength and a weakness in this case. On the one hand, covering a broad range of fields in a classical discipline permits student choice and sustains a kind of education and educational philosophy that the Biology Department has espoused, that of education over job training. On the other hand, this program trains a relatively low number of students for a relatively low number of jobs. Nonetheless, those jobs and the information in these fields are exceedingly important, and there is no substitute in our immediate geographical region for this educational program.

In terms of student education and success in subsequent pursuits, the Organismal and Conservation concentration serves the students well. Students are exposed to research-level lab and field techniques and experiences. These efforts aid both the student majoring in the fields of conservation, botany, zoology, and entomology, and also the general biology student and others seeking a K-12 teaching career.

Student numbers with a major in the concentration are relatively stable. Course enrollments are slightly up in recent years, especially in botany, entomology, and ecology courses. These classes have traditionally been favorites of students acquiring the BA Teaching degree or as preparation for the California Teaching Credential program. The numbers of students entering the teaching profession is high as a shortage exists in the state for science and math teachers. The organismal programs have been pared down to the essential elements (reduced number of units per zoology course, reduced offering or elimination of some specialized botany courses, complete revision of entomology program with a single entomology professor), so that the few professors left in these fields can offer a reasonable program. Being largely field based, this area uses a much lower share of departmental resources than the Molecular Biology, Microbiology, or Anatomy and Physiology (Systems’ Physiology) concentrations. Thus courses cost less on the average, and faculty use less research space for individual research labs. The paring-down process has been successful enough that a large number of the professors within the Organismal and Environment area that teach in the Organismal and Conservation concentration also teach GE courses and comprise most of the GE area.
within the Department. With upcoming retirements, further contraction of the Organismal program will be considered if the department and university are disinclined to hire new faculty in these positions.

We project that within the coming five-year period, the Organismal and Environment faculty will experience retirements by Drs. Kutilek, Matson, St. Omer, Balgooyen, Smith, and Kenk. Dr. Myatt’s FRP period will be over. Those retirements will leave Drs. Bros, Honda, Parr, Lambrecht, and Bruck as the only faculty left to teach organismal courses (the other professors in the area teach microbiology or GE courses). With these imminent retirements, hiring in this area will be essential to maintain even an abbreviated organismal/conservation biology program. The dilemma is further complicated by core and GE course instruction, to which the area has contributed greatly over past five years and beyond.

The faculty in the area understand the “supply and demand” dynamics of the predicament. Low enrollments are a function, not of any deficiency in program quality, but of the demographics of the South Bay Area and our identity as an urban (as opposed to state agricultural) university. Even so, those enrollment numbers make it difficult to demand equal replacement for retiring faculty and maintenance of the program over other higher enrolled ones. Given the longstanding tradition of the department, the implicit promises to faculty hired in this area to teach these kinds of courses, the uniqueness of the program in this locale, and the undeniable importance of conservation and organismal biology, the area feels justified in maintaining a reasonably sized organismal and conservation program. Making it too “bare bones” would render it ineffectual with regard to student learning, breadth, and preparation for and ability to compete for postgraduate opportunities. A compromise between the current three-emphasis concentration with a relatively full slate of upper-division specialty courses in those emphases and elimination of the program entirely is sought by the area. We do, however, feel that the current configuration of the concentration is already a compromise compared to the complete and systematic curricular packages of the past. With a modest number of new faculty over the next five years (2-3), the three emphases could be retained, the ideal situation and the one most beneficial to our students.

Short of that, we have begun contingency planning to prepare for a hiring freeze. We are in the process of designing a new condensed concentration in conservation biology that lacks emphases. It will be multidisciplinary to the extent that the students will be required to take upper division courses in each of zoology, botany, and entomology. The number of upper-division offerings will be cut back, making some available alternate semesters only or every other year or eliminating some entirely. Even with this new program, it will be impossible for the diminished O&E faculty to fill core course labs and GE courses without substantial help from graduate student TAs and the rest of the Biology faculty.

At the same time, the area has intensified the efforts begun during the last planning period to recruit more students to the concentration. These efforts have included tradeoffs with community colleges to articulate more of their courses with ours in
exchange for their faculty promoting our program and encouraging their students to transfer into it. A new initiative is being developed with De Anza Community College to facilitate ecology students transferring to SJSU to obtain a BA in Natural Science with an emphasis in Stewardship. The degree will be unique to this department as it will not require students to take many of the more rigorous preparatory science courses needed for Biology degrees, thereby facilitating timely completion of the degree. It is our hope that piggybacking this degree program on De Anza College’s popular, well-funded, and successful ecology program will attract many students.

Our efforts have also included development of alluring research programs and collaborations in which students can become involved. Thus our new Biodiversity Forum, a consortium of ecologists and conservation biologists, will focus on the study of organisms in their native habitats at both a molecular and organismal level. It will further develop on-line documentation of all of our animal and plant collections now housed in museums in the Biology Department at SJSU. Also enticing to students is a major project to identify all organisms present in a belt transect across the Santa Cruz mountains and Santa Clara Valley. Now in the planning stages, this project will involve students at all levels, result in research projects of different kinds to satisfy a wide variety of student interests, and strengthen our molecular and organismal courses.

Related to the research enhancements above, the long-term plan is to incorporate a biodiversity component in core Biology courses and appropriate upper-division courses in which it is now lacking and sorely needed. We hope to eventually develop a capstone course for seniors in the program that focuses on biodiversity.

Section C: Student demand

Enrollment in hard science, including biology, at the freshman level declined at the beginning of the last planning period but has picked up in recent years. This trend is reflected in the organismal and conservation area, where numbers in the last two decades were low but enrollment in our courses at the upper-division level has been steady or rising slightly on average. We have had to cancel few classes for lack of numbers; specialty courses are regularly offered on an annual or alternate year schedule. The number of majors in this concentration has also remained low but stable.

We assume that enrollments in biology will take an upswing in coming years, as the demand for professionals in the health care and biotechnology industries is rising. Interest in conservation and environmental preservation has been high in the Bay Area, a seat of unusually high environmental consciousness. We can only guess at the future numbers, but it is likely that interest in both the conservation and organismal ends of our program will remain constant in the next decade or more.

Activities conducted in association with the Biodiversity Forum are likely to attract local and foreign students and researchers, thereby increasing our visibility and opportunities for outside funding. Biotechnology education and industry are flourishing and expanding. A few of our courses address biotechnology directly (Plant Physiology, Population Genetics), the relationship between it and the organismal program is in
providing a foundation of knowledge of the structure, physiology, and behavior of organisms needed as background for biotechnology research design, understanding, and context. Many believe that, without basic organismal knowledge gained in courses such as ours, biotechnology will cease to expand. Perhaps more important is our effect on the voting public, of which our GE and major students are a part. As the debate over evolutionary theory grows more intense and pervasive, we will continue to educate in that arena by emphasizing the scientific facts and process that support the theory of natural selection - the central concept guiding the study of organisms. Similarly, the erosion of biodiversity worldwide stands as a major problem requiring greater awareness, knowledge, and resources to combat; it is addressed in any systematic and complete way only in the courses for which this area is responsible.

The program assesses its students for achievement of competency in several different skills and mastery of program content knowledge. Student learning objectives have guided the formulation of competencies to test (see Appendices 8-10). Many of these assessments are being phased in this year and so only baseline data and pilot data is available for any of them. See Appendices 11 and 16 for the early results from the ETS’s Major Field Test of Biology and for the program’s customized content test, respectively.

Section D: Societal need

The community benefits greatly from this program, as students who complete it take jobs in many governmental agencies. They serve in the management of resources, the restoration and protection of the environment, and the preservation of species diversity. Such agencies include, but are not exclusive to, the US Department of Agriculture, the US Department of Health, the US Forest Service, the US Fish and Wildlife Service, the US Natural Resource Conservation Service, California Department of Fish and Game, Vector Control, CalTrans, and planning and maintenance departments of every city and county in the state. Private businesses involved in these matters include environmental consulting firms, frequent employers of our organismal students. Many of our students become K-12 teachers, for which there is currently a shortage for math and science in California. Job prospects for entomology majors are exceedingly high, as essentially all qualified graduates acquire employment in an area of their expertise, especially forensics.

In response to societal and community demands for solutions to environmental problems such as global climatic changes and pollution, we have included new strategies for instruction that include the use of facilities in other departments at SJSU, such as GIS technology in the Department of Geology. In recent years, many environmental protections governing the use of natural resources have been eased or rescinded to allow greater freedom in land development. Destruction of natural habitats has thus accelerated, compelling an urgent need for educators to increase awareness of these matters.

Among the new strategies for better preparing our students is a course primarily on insects for prospective forensic scientists in the joint program in forensics with the Department of Justice Studies. The course uniquely includes training on molecular techniques for identifying organisms in their native habitats.
We also intend to design a new course in physiological ecology to better prepare our field-oriented students. This course is now envisioned to be team-taught by Drs. Lambrecht (a botanist) and Sneary (a zoologist), although other faculty members may become officially involved. It will likely replace Plant Physiology (Bot 102) and so will not add to the burden of the understaffed organismal faculty.

Ideas for these changes originated from within the faculty, while others came from suggestions elicited from our Biology graduates and community professionals. For example, applauded by community employers for our strong focus on biostatistics, we have continued to encourage students to increase their knowledge in this area.

Section E: Financial resources, viability, and efficiency

Courses in the Department of Biology are funded largely by the department’s budget. Occasional moneys are acquired from industry for computer labs or from the state lottery funds, but these are rare, unreliable, and usually earmarked for a particular purpose. Research funds are acquired from the federal government (National Science Foundation, US Department of Agriculture, National Institute of Health) or from private foundations. Outside sources of research funds in organismal biology are fewer than for molecular biology or for biomedical research in anatomy and physiology, and they generally provide less money. But as indicated above, courses and faculty research expenditures in this area are modest with the vast majority of its use of resources being for faculty teaching units.

This program uses few resources other than faculty. Resource use has been relatively constant over the last five years. Given an apparent stability in student enrollment in these courses, resources should remain stable with respect to supporting faculty time, equipment, and materials to run these courses. Should retirees not be replaced, revision of the major requirements would be necessary, but resource use would be reduced. The effectiveness of the program would necessarily diminish were courses left untaught. Conversion to only piecemeal offerings would severely reduce the quality of education.

Although class size in the upper-division courses is modest on average, many of our faculty members in this program are heavily involved in teaching and coordinating the larger CORE and GE courses in the department. The time and energy devoted to these large lower-division and CORE courses are high. In return, the organismal faculty has been compensated by being afforded the luxury of teaching low enrolled upper-division courses in our program.

Many faculty members have received extramural and intramural grants for research that have enabled them to enhance the quality and depth of their instructional activities. These grants support undergraduate and graduate research as well as helping faculty members in their own professional activities. For example, the RUMBA program, a grant for which was acquired by Dr. Parr as a co-PI with Dr. Soto in the Molecular area of our department, funds biotechnology research and provides stipends to undergraduates.
Section F: Interdependence of programs

Organismal and conservation courses satisfy requirements in several other concentrations in the department. For example, Plant Physiology (Botany 102) satisfies the physiology requirement of all students in the biology major. Evolutionary Genetics (Biology 118) serves as an admissible elective in the Molecular Biology concentration. Courses in our area are often used to fulfill the upper division electives of the BA Biological Sciences. Our Biology 156 (Pattern Recognition and Analyses) course is also a required course in the Marine Biology concentration and is a service course for Environmental Studies. And nearly all upper-division courses in this area satisfy requirements for the BA Teaching concentration, taken by students who will go on for their California Teaching Credential. In addition, many courses, including advanced specialty courses, in this area are part of the Biology minor, a version of which is required for students in the Restoration emphasis of the Environmental Studies program on our campus.

Section G: Capacity to contribute to an academic field

Outside funding has been proffered by several members, and most have recently published original research. Several of the professors in this group have public and private-sector contacts, for example in the biotechnology industry, environmental consulting firms, governmental agencies (California State Parks, California Fish and Game, Vector Control, US Forest Service, NASA, etc.) that provide student jobs, student internships, research collaborations, research materials, or small grants. Undergraduates benefit directly from faculty research efforts, as faculty members average about four students working in their research labs or in their field research, considerably higher than the departmental average. Presentations with students have resulted.

Students appear to be prepared for employment or for graduate school by the program, as most either find jobs in their field or are admitted to graduate schools. Even those who do not partake of the opportunity to participate in active and original research are involved in this kind of inquiry in the classroom. The teaching approach of the faculty in this area is one of hands-on training utilizing the scientific method. Furthermore, our students receive rigorous training in biostatistical analyses which has resulted in job opportunities for them and has helped build a solid reputation for the department in the statistical training of our students. In-class research projects are common in the upper-division courses followed by oral and written student presentations. Internships arranged by the faculty are also available to students as is seasonal work at California Fish and Game, the California Department of Food and Agriculture, the US Forest Service, NASA, and Counties of Santa Clara, Alameda, and San Mateo.

One of the major projects within our area focuses on improving the mathematical skills of our students. These instructional developments have received recognition from the National Institute of Health, which has provided preliminary funding for this project. The program under current review by NIH is especially noteworthy because it involves a
large, multidisciplinary approach that includes faculty in Biology, Chemistry, Physics, Geography and Mathematics. Not only will the quantitative aspects of the disciplines be emphasized, but units for in-depth examination in courses will focus on pertinent examples from other disciplines. For example, a chemistry class might investigate a topic of biological concern in order to illustrate a chemical concept. The chances for funding of this proposal are very high, as this review is in the second round and the majority of proposals in this round will be funded.

Section H: Availability of instructional activities  Ours is the only university in the South Bay that provides this curriculum. Community colleges have virtually no organismal biology beyond their introductory biology courses. Some have a course in environmental or conservation biology, but, of course, none of their courses are at the upper-division level. Stanford University and Santa Clara University have almost no upper division or graduate classes in these disciplines. UC Berkeley has organismal offerings in both integrative biology and resource management areas, but it has strict enrollment limits at the undergraduate and graduate levels. The closest university without these restrictions to have any comprehensive organismal program is Cal State East Bay, and theirs is modest compared to ours. UC Davis is the most extensive but is, of course, rather distant and serves a different student population. No other source of this kind of knowledge is available.
BS in Biological Sciences, Concentration in Marine Biology

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<td><strong>Preparation for the Major</strong></td>
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Section A: Centrality to Mission

The Marine Biology Bachelor of Science program provides a wonderful opportunity for our students. The program is the result of a collaborative effort between the Department of Biological Sciences at San Jose State University (SJSU) and Moss Landing Marine Laboratories (MLML), a research and education facility that is internationally famous. Because there is a large overlap in coursework with the concentration in Conservation and Organismal Biology, only material specifically relevant to the Marine Biology aspect will be presented here but, information contained in the description of the Conservation and Organismal Biology is pertinent.

Students in this program receive a degree that is sufficiently rigorous and broad in scope that they can pursue virtually any occupation or graduate program that requires a BS degree in the biological sciences. However, many, if not most, of our students go on to graduate school to receive advanced degrees in the marine sciences. Our goal is to help students obtain a solid foundation in biology, chemistry, physics and biostatistical analyses along with training and experience in applying the scientific method. As preparation for the major, students take inorganic and organic chemistry along with biochemistry. They take two semesters of physics. In addition they receive extensive training in quantitative analysis which consists of a course in computer literacy and two advanced courses in biostatistical analysis. One of the latter includes multivariate analyses which is a unique course that is not offered in any other undergraduate biological science curriculum in the United States and, perhaps, the world. Through courses in physiology and ecology, students learn how organisms function, interact and how they are
adapted to their environment. They learn about genetics and microbiology. To help our students become productive scientists and better citizens, throughout the curriculum students are provided opportunities to enhance their communication skills via written assignments and oral presentations. In addition, virtually every course provides opportunities for our students to be problem-solvers.

Students in the Marine Biology degree program are given the opportunity to study and, hopefully, appreciate the complexity of living organisms and the myriad mechanisms that the organisms have developed to cope and thrive in their environments. The marine system is extremely diverse including many distinct types of habitat, estuaries, intertidal regions, the ocean bottom, thermal vents, mid ocean and ocean surface, each of which contain an amazing variety of organisms. Examining these systems can help students understand: the critical relationship between the marine environment and the terrestrial/freshwater environments, terrestrial systems through their marine analogs. Students in the program are provided with the essential elements to help them appreciate the challenges any species must overcome to survive, to gain an understanding of the interdependence of species and to appreciate the importance of global biodiversity.

Section B: Quality of the instructional program

The quality of instruction and experience provide to students in the Marine Biology program is outstanding. At San Jose State University, students learn to be functional scientists. The level of experience and hands-on learning experience provided for the students, the hallmark of our program, is not surpassed in the CSU and UC systems; virtually every course offering has a laboratory unit. Students experience and learn research techniques in both the lab and the field. The lecture portions of the courses are taught by Professors as are most of the laboratory sections. In general, the faculty members of the Biological Sciences department are dedicated to providing outstanding learning environments for our students; four of the faculty involved in courses for this major have been recognized as Teacher Scholars at the SJSU. To facilitate students with interests in research, the department has created several scholarships programs for which marine biology students are eligible.

After being prepared at SJSU, students spend two semesters at the MLML facility. Here, students in this program get the chance to learn from faculty who are some of the best in their field. The faculty at MLML obtain, on average, $500,000 per year in research funding and have published articles in the top journals in science. Their courses are geared for graduate students but, because our students have been trained at SJSU, they do well. As most students who pursue a career in marine biology obtain advanced degrees in marine science, the MLML experience provides a stepping stone to graduate school; the students can either enter the MS program at MLML or they can apply elsewhere but with recommendations from the MLML faculty.

The habitats near the lab provide unique experiences for the students. Students are able to go on cruises to sample organisms and water chemistry data from Monterey Bay Submarine Canyon which is one of the deepest near shore underwater canyons in the world. Elkhorn Slough is one of the largest unspoiled estuarine wetlands along the west coast and is practically next door to MLML. Sand dunes and beaches which are important for many species are nearby the lab.
Students also have access to the extensive kelp forests in Monterey Bay the MLML facility is located between two large upwelling centers in the ocean which provides an opportunity to study coastal oceanic processes. No other marine research center has these diverse types of habitat in such close proximity.

Section C: Student demand

The number of students in the Marine Biology program declined in the early 90s but is now increasing again. In 2000 there were eighteen students enrolled but, by 2004 enrollments were up to 30 (Figure 1). There are two entry levels for our students, those that attend as freshmen and those who transfer in from other colleges. Both the number of freshman enrolled and number of transfer students are increasing (Figure 2). The number of seniors is rising as well (Figure 2).

An inspection of Figure 2 reveals that retention of students is a problem. The number of students enrolled in their sophomore year is much lower than freshman enrollment for the preceding year. Anecdotal information from the students indicates that one of the major hurdles for students is the chemistry requirement; many students do understand why chemistry is important and find it difficult to master. As understanding of chemistry is essential, this poses a problem in retaining students but the problem is not unique to the Marine Biology program. To try to address the chemistry (and math) issues, many faculty members from several departments have applied for an NIH grant for improving quantitative skills of students in which one of the main objects is to integrate learning among the different disciplines. The idea is to more fully incorporate related concepts from math, physics, and chemistry into introductory biology courses and incorporate biological concepts into introductory courses in math, physics and chemistry. It is hoped that, by integrating multiple disciplines, students will understand and appreciate their relevance to biology.
Section D: Societal need

The societal need for the program is two-fold. From a strictly marine perspective, the importance of understanding the implications of changes to the marine environment to humans cannot be understated. The marine biome comprises 70% of the surface of the world. Much of the oxygen we breathe comes from photosynthesis in marine algae and marine plants. A large portion of our diet comes from the sea as do many important commercial products. Marine species and their habitats provide an importance aspect of recreation as evidenced by the popularity of the Monterey Bay Aquarium and water sports such as snorkeling and scuba diving. In addition, major advances in medical research, such as the study of nerve function, have been made through the study of marine invertebrate species.

In a more broadly defined context, the community benefits because many of these students take employment positions that affect our society. They obtain jobs in government and private agencies whose charge is the management of resources, the restoration and protection of the environment, and the preservation of species diversity. Many students also go on to become teachers. Because the BS program in Marine Biology provides excellent backgrounds in chemistry, biology and mathematics, students who become K-12 teachers can help fill the void for science and math teachers.

Section E: Financial resources, viability, and efficiency

The financial base for courses in the BS Marine Biology degree program is funded through the departmental budget and through MLML. For the Department of Biological Sciences, occasional grants provide some equipment needs but those have not been substantial. Therefore, the major source of income is a function of student enrollment. The good news is that the equipment and supply costs for most of the courses are fairly small so the main cost if for faculty. The bad news is that the number of faculty to teach these courses is declining precipitously because of retirements. (Figure 3). By 2008, if faculty members lost to retirement are not replaced, the number of available full-time faculty members will be half of what it was in the year 2000. The problem of loss in faculty is exacerbated by the fact that many of these faculty are involved in teaching both the core courses for all of our degrees and several GE courses. This leads to two negative impacts. First, reduction in faculty will certainly result in a reduction in the frequency with which courses are taught; this will most likely reduce the
likelihood that our students can graduate in a timely fashion. The second impact is a potential loss in FTES if the students are unable to get the courses they need. For MLML, the situation is reversed; the state only provides a very small budget and most of their financial base is from soft money.

The BS program is relatively efficient as compared to the concentration in Conservation and Organismal Biology. This is because the major requires virtually no electives that are typically underenrolled.

Section F: Interdependence of programs

The Marine Biology program consists of courses that satisfy requirements for the Conservation and Organismal Biology concentration which, in turn satisfy requirements in several other concentrations in the department. The major difference in course offerings comes from the courses taught at MLML. This program depends heavily on the MLML whose financial base is very strong.

Section G: Capacity to contribute to an academic field

As stated previously, students who are serious about pursuing a career in marine biology almost always go on to a graduate program. Most of the students who graduate with a BS degree with a concentration in Marine Biology get accepted in a graduate program or find employment in a related field. The quantitative training we provide is simply not available at any other undergraduate institution and our students perform very well in that area. MLML faculty have very strong publication records and active research programs that complement the strengths Marine Biology students find in the Department of Biological Sciences.

Section H: Availability of instructional activities

Several biology departments in the CSU system offer a marine biology program similar to ours and send their students to MLML. However, SJSU provides, conservatively, over half of the undergraduate students at MLML. The two things that make our program more desirable. First, is the fact that SJSU is in the closest proximity to MLML and SJSU is the parent campus for the CSU MLML consortium. It is likely that most students enroll in Marine Biology at SJSU because it is simply easier. Secondly, our program is often recommended to students seeking information about MLML and about UCSC because of the rigorous field and quantitative training we provide.

Assessment

Briefly, we are assessing our students’ achievement in our program and our program’s success at achieving its student learning objectives in a multifaceted approach described in Appendix 7 and Appendix 8. Our students will also take the Educational Testing Service’s Major Field Test and the Organismal and Ecology Area’s Assessment Test. Baseline data for this latter exam is provided in Appendix 16. Specific learning objectives and assessment tools are discussed below.
1. Program Goals

a. to give students the skills, experiences, and content that prepare them for careers or advanced study in marine biology or related fields.

b. to help students develop the skills and the desire necessary to become life-long learners.

c. to provide students with sufficient background to contribute in the scientific and societal arenas.

d. to graduate students who hold themselves to the ethical standards that are consistent with the expectations of a university education.

e. to provide an environment that allows students to experience the joy of scientific discovery and the value of learning.

f. to educate students about the anatomy, morphology, and other structural features, the physiology and other functional features, the classification and evolutionary history and pressures (taxonomy and systematics) of groups of organisms on earth, including plants (botany), animals (zoology), and insects (entomology, a sub-discipline of zoology)

g. to educate students about the interactions within and between these groups of organisms as well as their interaction with abiotic factors in their surroundings (ecology).

h. to teach our students of the value of these organisms, in terms of human exploitation of them to some extent but also in terms of their intrinsic interest and role in ecosystem processes (conservation).

2. Performance Outcomes for the Major

a. to develop a foundation of biological knowledge and laboratory and field skills

b. to develop critical thinking and problem-solving skills

c. to work effectively as individuals and in groups

d. to develop strong oral and written communication skills

e. to develop fundamental quantitative, computer, and information literacy

f. to develop an appreciation for and understanding of the role and impact of biology on society.
g. to have an understanding of conservation biology, entomology, zoology, or botany

h. to have an understanding of ecology

3. Assessment Strategies

Generally our faculty tend to be progressive in experimenting with teaching and assessment strategies. Because no new resources are available to conduct assessment in the major, our strategy is heavily dependent on assessment techniques that faculty use during the normal course of instruction. Meeting performance and learning objectives for individual classes will be assessed by one of more of the techniques listed below:

a. Written Examination Methods

• Practical laboratory examinations (e.g., identifying species or anatomical parts)
• Short answer questions, fill-in questions, essay questions, problem solving questions, word problems, quantitative calculations, multiple choice questions
• Hands-on demonstrations of computer competency
• Quizzes
• Take-home examinations

b. Oral Assignments

• Oral examinations
• Oral presentations
• Oral questioning during lecture
• Small groups of students teaching the class for a day
• Small group discussions in lecture or lab
• Small group problem-solving

c. Written Assignments

• Mock journal article write-ups
• In-class essays
• Field notebooks
• Written reviews of scientific articles
• Field trip reports
• Research projects
• Peer editing
• Laboratory reports
• Papers on controversial issues
• Group projects
• Review papers
### Course Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Education Requirements</strong></td>
<td>39</td>
</tr>
<tr>
<td>Of the 51 units required by the university, 12 may be satisfied by specified major and support requirements. Consult major advisor for details.</td>
<td></td>
</tr>
<tr>
<td><strong>American Institutions</strong> (6)</td>
<td></td>
</tr>
<tr>
<td>Of the 6 units required by the university, all may be satisfied within general education requirements as specified in the schedule of classes.</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Education</strong></td>
<td>2</td>
</tr>
<tr>
<td>PHYS 002A and PHYS 002B (8); MATH 030 or other calculus (3); BIOL 100W (3); BIOL 005 (3)</td>
<td></td>
</tr>
<tr>
<td><strong>Requirements in the Major</strong> (50)</td>
<td></td>
</tr>
<tr>
<td>BIOL 001, BIOL 002, BIOL 003, BIOL 004 and BIOL 006 (14); BIOL 107 (4); MICR 101, MICR 127, MICR 141, MICR 141L, MICR 142 and MICR 142L (20); Complete twelve units from: BIOL 115, BIOL 116L, BIOL 116, BIOL 120A, BIOL 120I, BIOL 124, BIOL 125, BIOL 135, BIOL 135L, BIOL 155 or BIOL 156, BIOL 233, MICR 122, MICR 123, MICR 140, MICR 170, CHEM 055, CHEM 121S, CHEM 130A, CHEM 130B (other elective courses by prior advisor approval) (12)</td>
<td></td>
</tr>
<tr>
<td><strong>Requirements in the Minor</strong> (23)</td>
<td></td>
</tr>
<tr>
<td>CHEM 001A, CHEM 001B, CHEM 112A, CHEM 112B, CHEM 113A, CHEM 120S and CHEM 135</td>
<td></td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Units:</strong></td>
<td>131</td>
</tr>
</tbody>
</table>

### A. Centrality to mission

#### Mission and Goals of the Program

The mission of the B.S. Microbiology concentration is to prepare its majors for employment or graduate work in any field requiring knowledge of microbial life, e.g., health care, biotechnology, environmental sciences, and the food industry. The specific program goals are to provide a sound background in the basic biological and physical sciences, provide training in the isolation and identification of microbes (bacteria, fungi, and viruses), teach the basics of the mammalian immune system, offer a selection of upper division courses which allows students to pursue specific interest areas within microbiology, including prerequisite courses for training and licensure in Clinical Laboratory Science, and provide students and faculty with adequate laboratory space, supplies, and equipment to foster an environment conducive to effective teaching, learning, and scholarship.

#### Program Contributions to the Mission of SJSU

The B.S. Microbiology concentration provides its students with the intellectual and practical skills required for successful careers as microbiologists and gives them a broad-based understanding of how this discipline, and science in general, can be used to meet societal needs.
B. Quality of instructional program

The microbiology area endeavors to provide quality instruction by having tenure track faculty direct the instruction in all microbiology courses, maximizing the laboratory experience in microbiology courses, assess instructors through student and peer evaluation, and encourage faculty and students to engage in research activities. When compared to the undergraduate curriculum recommended by the American Society for Microbiology, the required courses and elective opportunities that we offer match up very favorably (see below). As resources for assessment become available we propose to revisit the curriculum often to ensure relevancy, currency and heuristic value.

Microbiology Faculty (Boothby, Kibler-FERP, Murray, Ouvrney and Rech) provide instruction in University Service- (Microbiology 20-General Bacteriology), Department Service-(Biology 107/107S-Immunology, Microbiology 101-General Microbiology), and Microbiology majors-courses (below). Research in environmental microbiology, general microbiology, immunology, and pathogenic microbiology continues to provide infusion of new concepts and technology into the program and reinvigorate faculty and students. Research provides engagement with academic content, colleagues and students, and we view teaching in the research environment an essential component of our instructional mission.

The microbiology program has developed a reputation locally (among medical, biotechnology, and public health institutions) as a source of well-trained responsible and talented entry-level microbiologists. Graduates of this program have been very successful in the job market. Several continue on to post-graduate state certification in Clinical Laboratory Science, which qualifies them for medical laboratory positions. Feedback from program alumni and local employers has been very positive.

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**ASM's Curriculum Recommendations**

Box 1. Core Courses for Microbiology Majors

- Introduction to Microbiology (with lab)  
- Microbial Physiology (with lab)  
- Microbial Genetics (with lab)  
- Microbial Diversity and Ecology (with lab)  
- One advanced course that includes laboratory  
- Capstone course (e.g., senior seminar presentation, independent research, project, internship)

Box 2. Suggested List of Elective Courses for Microbiology Majors

- Immunology  
- Pathogenic Microbiology  
- Food and Dairy Microbiology  
- Environmental Microbiology  
- Marine Microbiology  
- Industrial and Applied Microbiology  
- Biotechnology  
- Bioinformatics  
- Virology & other cellular agents  
- Parastology/Protozoology  
- Mycology  
- Phycology  
- Epidemiology  
- Public Health  
- Undergraduate research and internship  
- Careers in Microbiology (see text)  
- Bioethics (see text)

Box 3. Support Courses for Microbiology Majors

- General Biology with lab (1 year)  
- Cell and molecular biology  
- General Chemistry with lab  
- Organic Chemistry with lab  
- Biochemistry (1 semester)  
- Math (through calculus)  
- Physics (1 year)  
- Statistics (1 semester)  
- Scientific Writing and Technical Communication (see text)
Courses Taught by Microbiology Faculty

University Service:
MICR 020  General Bacteriology

Department Service:
BIOL 107S  Fundamentals of Immunology
BIOL 107  Immunology
MICR 101  General Microbiology

Microbiology Majors;
MICR 122  Microbial Diversity
MICR 123  Food Microbiology
MICR 141  Microbial Physiology
MICR 140  Hematology
MICR 141  Pathogenic Microbiology I
MICR 141L  Pathogenic Microbiology I Lab
MICR 142  Pathogenic Microbiology II
MICR 142L  Pathogenic Microbiology II Lab
MICR 170  General Virology

C. Student demand
By the end of this academic year the enrollment in Microbiology courses will have more than doubled over the past five years, from 400 to about 1000 students in all three instructional areas (university service, department service and microbiology majors—see below and Appendix 1). The B.S. Microbiology has grown from less than 10 new declared majors entering the university in 2000/2001 to more than 50 entering during 2004/2005 with more than 600 new students applying to the major.

BS Microbiology

In spite of growing student numbers and decreasing numbers of tenure-track faculty, for Fall 2005 there were only 6 cases of unmet demand in Microbiology 20 (total enrollment 195), 13 in Microbiology 101 (total enrollment 76) and 2 in Microbiology 141L (total enrollment 19). In total the unmet demand for these courses was 12.5% of the unmet demand for the Biology department for Fall 2005. With the current and projected need for microbiologists in health care, research and biotechnology, we expect the number of majors to grow, or at a minimum, remain stable.

Enrollment in University Service (Micro 20), Department Service (Bio 107/107s and Micro 101), and Majors courses taught by Microbiology Faculty 2000-2005. Note that 2005 data is for Fall semester only.

The Microbiology Area faculty also provide instruction in the areas of university- and department-service, and instruction for students seeking entry into the Clinical Laboratory Sciences (CLS) Program. The American Society for Microbiology reported that nationally, the numbers of CLS-level certifications being issued in the United States have fallen over the last several decades. The number of graduates of medical technology programs in the United States, has been reduced from 6,121 graduates in 1975 to 1,300 graduates in 2002. The also reported that the capacity for training medical technologists has dwindled from 791 accredited programs in 1970 to only 243 in 2002 (ASM News CLS 2004.htm). The situation in California for CLS training is even more acute (see CLS Program). Most students enrolling in Microbiology 20 are pre-nursing students. The demand for Microbiology training for pre-Nursing majors has expanded from 36 students per year to almost 500 per year presently. Since both CLS and Nursing Programs are expanding, commitment to these instructional activities will continue to grow.

D. Societal need
Well-trained microbiologists are needed in many aspects of our everyday lives. They are trained to detect and study pathogenic microbes which cause disease in humans, pets, livestock, wildlife, and plants; develop vaccines and treatments for new and recurring
diseases; maintain quality control standards for microbial contamination of drugs, food, medical devices, and water; develop microbial remediation methods (bioremediation) to degrade environmental toxins in water and soil; and produce therapeutic and other commercially important proteins in recombinant microbes for the biotechnology industry.

Societal need for microbiologists has increased over the past 10 years and the trend will continue in the foreseeable future. Food safety issues (E. coli, listeriosis, botulism and mad cow disease), environmental concerns (MTBE contamination, oil spills and wetlands restoration), and the emergence of new diseases (SARS and AIDS) and recurrence of old ones (tuberculosis and influenza) will keep the student demand for this program high, as will the need for microbiologists in the biotechnology industry. Current concerns about the threat of bioterrorism, spread of West Nile virus and the cloud of a modern era flu pandemic require a cadre of well-trained microbiologists well into the future.

E. Financial resources, viability, and efficiency
The Department of Biological Sciences has been the primary source of instructional funds for the microbiology program. Microbiology laboratories are extremely labor-intensive to set up, requiring a separate Microbiology and Molecular Biology Service Center staffed by three full-time instruction support technicians and one instructional support assistant. All culture media, microbial cultures, and most of the equipment and supplies are purchased from departmental funds. Donation from biotechnology companies supplement equipment and supplies used for research and instruction. NSF, lottery, and private grants have supported faculty research efforts.

Over the past five years, two tenured faculty members have fully retired (Grilione and Haight), one tenured faculty member has entered the faculty early retirement program (FERP-Kibler), and one new tenure-track faculty member has been hired (Ouverney). A search for a new tenure-track immunologist is anticipated for Spring 2006. Although this might appear to almost balance out, the microbiology area was understaffed prior to the hiring of new faculty. As a result, the area has had to rely on several temporary faculty over the past five years to cover the general microbiology lectures and labs (Micro 20 and 101), hematology lecture and labs (Micro 140), immunology lecture and labs (Bio 107S/107), pathogenic microbiology labs (Micro 141L), and virology (Micro 170). Environmental Microbiology (Micro 122), a course recommended as a core requirement for majors by ASM, has not been offered during the last five years due to understaffing.

Temporary instructors have been good, but they could become unavailable at any time. Furthermore, temporary instructors lack the long-term commitment to coordinate complex laboratory instruction with multiple sections, and often are hesitant to initiate the employment of up-to-date technology in them. This limitation often compromises our ability to offer a modern, laboratory-based microbiology curriculum. One more tenure-track hire in the next few years would stabilize this situation in the short term. Currently the technical staff is exceptionally good and adequate for the needs of the program.
Teaching equipment is reasonably good. New Sorvall centrifuges (2), shaking incubators (2), and microscopes (20) were obtained several years ago for the teaching labs and several pieces of donated equipment (incubators, centrifuges, biohazard cabinets, etc.) have been put to good use. Three fluorescent microscopes have been outfitted on a mobile cart are now available for instructional and research use, and one of two aging autoclaves (used to sterilize media and glassware) has been replaced. Laboratory space for teaching has been maximized by a recent reshuffling in the microbiology area. Department and College funds to support of faculty research and travel have increased, but are still extremely limited for this expensive discipline.

Limited support in the form of new tenure-track faculty, supplies and equipment has been the biggest hindrance to the effectiveness of the microbiology program. This has not been felt so much at the undergraduate level as it has at the faculty and graduate student level. The Department’s budget is far too low to absorb the cost of major equipment when it fails. Service contracts for advanced instruments is expensive, and replacement costs are exorbitant. A single autoclave costs at least $40,000, nearly half of the Department’s entire operating budget! These issues must be addressed to avoid negative impacts on an otherwise excellent BS program in microbiology.

<table>
<thead>
<tr>
<th>Summary of Future Resource Needs by Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students: More research opportunities at SJSU.</td>
</tr>
<tr>
<td>Faculty: One-two more tenure-track hires within five years.</td>
</tr>
<tr>
<td>Curriculum Maintain, modernize, and enhance diversity of microbiology offerings and maintain emphasis on LABORATORY instruction. Increase interdisciplinary projects and classes (e.g. fermentation techniques and chemical engineering, physics modeling extreme environments and astro(micro)biology. Introduce a senior research/thesis option.</td>
</tr>
</tbody>
</table>

F. Interdependence of programs
The program faculty members provide instruction in three areas of the university: university service, department service and microbiology majors (see Appendix 1).

In terms of university service, microbiology faculty teach a lower division service course in microbiology (Micro 20) for nursing, food science, and other health-related majors outside the College of Science. In addition, all Biochemistry majors are required to take general microbiology (Micro 101), and some Nutrition and Food Science majors are required to take food microbiology (Micro 123).
In terms of departmental service, nearly all biology majors are required to take the major’s upper division general microbiology course (Micro 101), and most majors in Molecular and Cell Biology and many of those in Systems Physiology take immunology (Bio 107 or Bio 107S).

G. Capacity to contribute to an academic field
All full-time, tenured or tenure-track microbiology faculty members are actively involved in research in areas such as microbial ecology, bioremediation, pathogenesis and immunity. These faculty have brought in research funding from the federal government (NSF), local government (Santa Clara County Department of Health), and private companies (Clinimetrics). The microbiology faculty are active in professional societies, present their work at professional conferences and seminars and also publish in books and peer-reviewed journals.

<table>
<thead>
<tr>
<th>Microbiology Faculty 2000-2005 Professional Activities*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Presentations: 21</td>
</tr>
<tr>
<td>Journal Publications: 10</td>
</tr>
<tr>
<td>Book Chapters: 3</td>
</tr>
<tr>
<td>Funded Grants:</td>
</tr>
<tr>
<td>Principal Investigator: 11 ($525,064)</td>
</tr>
<tr>
<td>Co-Principal Investigator: 8 ($1,088,099)</td>
</tr>
<tr>
<td>Total: 19 ($1,613,163)</td>
</tr>
</tbody>
</table>

(*Boothby, Ouvryne and Rech data only)
H. Availability of instructional alternatives

Regional institutions include community colleges, Stanford University, University of California, Berkeley, University of California, Santa Cruz, Santa Clara University, San Francisco State University, and California State University East Bay. Local community colleges only offer the equivalent of Micro 20. Some regional universities (UCSC, Stanford and Santa Clara) provide degrees or programs that include microbiology content which are part of general biology, graduate or professional programs. UCB has a Microbial Biology degree that requires two courses in microbiology (General Microbiology and Microbial Genomics). Each course has 48 hours of lecture with no laboratory experience. Five elective courses are required, and none have a laboratory component.

Regional CSU institutions provide degrees or programs that encompass microbiology, but can’t match the hands-on laboratory training SJSU. San Francisco State University offers allied health microbiology (the equivalent of Micro 20), and a general education course in microbiology. General Microbiology is not required of most biology majors. SFSU offers a B.S. Microbiology degree and a B.S. Clinical Science degree, but no Chemistry Minor is required. CSU East Bay offers allied health microbiology (the equivalent of Micro 20), and courses in general education microbiology. General Microbiology is not required of most biology majors. CSUEB offers a B.S. Biology degree with a Biomedical Laboratory Sciences option, but no Chemistry Minor is required.

Using online catalogues, a comparison of microbiology instruction at SJSU and our most closely related, regional institutions (SFSU and CSUEB) was made by computing the instructional hours in Microbiology courses. For SJSU and SFSU (semester institutions) hours were computed as the weekly hours times 16 weeks, and for CSUEB (quarter system institution) hours were computed as the weekly hours times 9 weeks. The data indicate that in all cases SJSU’s B.S. Microbiology program provides more hours of laboratory instruction and more total instructional hours in microbiology than comparable regional institutions.

Many of the students in our program continue on to Clinical Laboratory Sciences Programs at SJSU and elsewhere. We have also articulated two Medical Laboratory Technician (MLT) programs at community colleges with our B.S. Microbiology degree for students seeking admission to CLS programs.
Summary

The Microbiology program's instructional and research strengths include microbial physiology, ecology, bioremediation, pathogenesis and immunity. The undergraduate curriculum in these areas, and in general microbiology, is in good shape and has been very effective in training entry-level microbiologists to meet the needs of local employers. The program's major challenges are to maintain and enhance tenure-track faculty and equipment so that student instruction and faculty research can continue or improve. We would like to offer more research experiences for our students. Forging ties with biotechnology and environmental science industries for joint ventures and placing more students in summer internship positions are opportunities that need to be addressed in the future.

The microbiology program compares favorably to the curricular recommendations of the American Society for Microbiology (see below). No other regional institution offers a comparable array of Microbiology courses at the undergraduate level. As resources become available for program assessment and improvement, efforts can be made to improve instruction in microbiology. The faculty and staff take special pride in the level of laboratory instruction. Assessment should include a cost-benefit analysis of the commitment of time and resources to laboratory and overall instruction in the Microbiology Program at SJSU compared to other institutions.
<table>
<thead>
<tr>
<th>Required Preparation Courses:</th>
<th>American Society for Microbiology Curriculum Recommendations</th>
<th>San Jose State University Microbiology Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Organic Chemistry</td>
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<tr>
<td>Organic Chemistry Lab</td>
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</tr>
<tr>
<td>Biochemistry</td>
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</tr>
<tr>
<td>Physics</td>
<td>yes</td>
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</tr>
<tr>
<td>Other Science Courses (e.g., Statistics, Computer)</td>
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<td>yes</td>
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<tr>
<td>Required Microbiology Courses:</td>
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<tr>
<td>Immunology (Biol 107)</td>
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<tr>
<td>Immunology Lab (Biol 107/Lab)</td>
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<td>48</td>
</tr>
<tr>
<td>General Microbiology (Micro 101)</td>
<td>yes</td>
<td>32</td>
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<tr>
<td>General Microbiology Lab (Micro 101L)</td>
<td>yes</td>
<td>96</td>
</tr>
<tr>
<td>Microbial Physiology (Micro 127)</td>
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<tr>
<td>Microbial Physiology Lab (Micro 127L)</td>
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</tr>
<tr>
<td>Pathogenic Microbiology (Micro 141/142)</td>
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<tr>
<td>Pathogenic Microbiology Lab (Micro 141L/142L)</td>
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<td>200</td>
</tr>
<tr>
<td>Or other required courses (e.g., genetics)</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

**Microbiology Electives Offered:**

| Hematology (Micro 140)        | 32                                           |
| Hematology Lab (Micro 140L)   | 96                                           |
| Food Microbiology (Micro 123) | yes                                          |
| Food Microbiology Lab (Micro 123L) | yes                                   | 16                                            |
| Virology (Micro 170)          | yes                                          |
| Microbial Diversity (Micro 122) | yes                                   | 48                                            |
| Microbial Diversity Lab (Micro 122L) | yes                                   | 16                                            |
| Or other electives to 12 units (e.g., molecular genetics) | yes                                                   |
| Or other electives to 12 units (Lab specified) | yes                                                   |

*Hours of instruction

Comparison of SJSU B.S. Microbiology curriculum in hours of instruction with curriculum recommendations from the American Society for Microbiology.

**Direction of the Program for the Last Five Years**

Our previous plan's implementation has been made possible by the hiring of one new faculty member in the microbiology area. The general, physiological and pathogenic microbiology curricula have been enhanced considerably. We still need to address the need for course development in the environmental microbiology. More research laboratory space and more efficient use of teaching laboratory space has continued. Newly hired faculty and Microbiology Service Center staff over the past five years have improved the currency, efficiency and productivity for providing laboratory course experiences for our students. We have not been able to hire adequate tenure-track faculty, or maintain or replace instructional and research equipment as much to our satisfaction. Overall, the microbiology program is in better shape than it was five years ago, and it is continuing to improve.

**Assessment Plans**

The Microbiology Program is taking part in the department-wide assessment program that assesses writing skills, team work skills, information competence and laboratory skills among others and assesses content knowledge using the ETS's Major Field Test in Biology (see Appendix 11) and our Microbiology Assessment Test (see Appendix 14). This process is ongoing and, at this point, we primarily have pilot and baseline data. We are committed to curricular excellence and are confident the assessment results will indicate that we are achieving our goals.

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## Appendix 1

### ACADEMIC YEAR ENROLLMENT

<table>
<thead>
<tr>
<th>UNIVERSITY SERVICE COURSE</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005 Fall</th>
</tr>
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<td>MICR020 ENROL</td>
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<td>71</td>
<td>104</td>
<td>294</td>
<td>195</td>
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December 7, 2005

To the Members of the Program Planning Committee:

Thank you for your review of our Program Plan from five years ago. It is unfortunate that our Program Plan was delayed in our Dean’s office and did not get to the Committee until five years after we completed it. We appreciate your comments and suggestions for how we might change the organization of our Program Planning document and our assessment strategies for future submissions. Unfortunately, the Committee’s letter came to me in November, after many faculty members had invested in writing our current planning document and we will not be able to follow those suggestions for this review period. We will, however, be very happy to follow any suggestions that come out of this current review for our next review in five years.

Respectfully,

Sally Veregge
Chair
Department of Biological Sciences
0. Organization of the Self-Study and Program Plan for the Biological Sciences Dept.
Policy S01-5 of the Academic Senate of San Jose State University describes the
organization of the program planning process that programs on campus are to undertake
every five years. Programs are defined in the document as “a sequence of studies leading
to a degree or teaching credential. When separate descriptions are provided in the
University catalog for similar sequences of study, they are treated as different programs
to be reviewed.” (italics added). It is for this reason that our self-study and program
planning document is divided into sections, one for each academic concentration and
degree program in the department. While there is some overlap of faculty and courses,
the programs are different enough in student demand, societal need, financial viability,
interdependence with other programs, capacity to contribute to the academic field, and
the availability of instructional alternatives that there is very little redundancy in the
program-specific documents. It is appropriate that each program be considered
separately and that planning for each program is done independently for the kind of
specific analyses and planning this process requires.

That said, it is surely helpful for someone looking at a program in isolation to understand
the context in which that program exists. The department has a unified mission, a
consensus on several overarching objectives for our graduates, an integrated assessment
strategy, and ultimately a singular resolve to sustain the high morale and collegial
environment we have carefully developed over the years. This section of the program
planning document is an overview which makes connections between the individual
programs described in the subsequent sections and makes links to primary data that has
been included in appendices. Taken together, the document is a description of how our
programs have been performing these last five years, an analysis of trends we observe, an
identification of future opportunities and challenges, and our plans for the next five years.

1. Description of the Department of Biological Sciences
The Department of Biological Sciences hosts eight undergraduate programs (the BA and
BS degrees and the named concentrations in each) and six graduate programs.(the MA
and MS degrees and the named concentrations in each). The department has a large
faculty and student population and has complex curricula and facilities. Taken together,
the department’s undergraduate and graduate programs serve the societal need for:

• middle & high school teachers and community college instructors
• health professionals and paraprofessionals
• technical professionals in academia and the biotech and pharmaceutical industry
• scientifically trained civil servants in local, state, and federal agencies
• biologists who focus on characterizing and preserving the natural world
• broadly educated citizens who play essential roles in all aspects of society

Over the years the department has consolidated and reduced its concentrations to simplify
the choices students need to make and the program oversight process, to eliminate
programs that had outlived their utility and suffered low student enrollments, and to
enhance the quality of the remaining programs.
In the five years leading up to our last program review (2001) the department took the following actions:

• we committed ourselves to enhancing the quality and rigor of our GE offerings.
• we revised and strengthened our concentrations preparing future K-12 teachers.
• we created a broad and flexible BA degree program for students who wanted to use their biology training in less traditional ways, allowing courses in business, psychology, and other disciplines to be included among their electives.
• we consolidated our BS degree programs into three curricular focus areas: molecular and microbiology; anatomy and physiology; and conservation and organismal biology.
• we hired interdisciplinary (across the subdisciplines of biology) ‘bridge’ faculty to link our curricular programs and weave the curricular offerings of the department together.
• we recommitted ourselves to providing all our students with extensive hands-on field and laboratory experience exceeding that offered by comparable institutions.
• we enhanced our molecular biology program in particular, with significant investments in new equipment and instrumentation, technical support, and curricular development.
• we increased our graduate course offerings and the size of our graduate program.

These actions have been proved timely and wise over the last five years where the medium-term effects of them have become apparent. Our previous program planning has served us well in most respects. Though we propose the elimination of one program (BA Biological Sciences, Preparation for Teaching) that has a very low enrollment and equally good alternative paths within the department for students interested in teaching, the majority of our proposed changes for the next five years concern faculty hires to replace retiring faculty and support essential courses and to the implementation of a multi-layered cross-program assessment plan.

2. Mission of the Department
The mission of the Department of Biological Sciences is to give students a personalized educational experience that encompasses the theoretical, quantitative, and applied aspects of the biological sciences. We provide students with intensive, practical laboratory and field experiences and advanced elective options that prepare them to enter successfully either the workforce or advanced degree programs. We also help our students develop critical thinking and problem-solving skills. Finally, we strive to enable all our students to communicate effectively about biological issues that are central to human welfare. Our commitment is to accomplish this mission by having permanent faculty members teach in laboratories as well as lecturers. We provide our students with opportunities outside the classroom to work and interact with faculty.

3. Changes to the Curriculum Since 2001
All our undergraduate majors now are required to take a course called The Profession of Biology (Bio 4) to introduce them, ideally at the outset of their college career, to the kinds of work a biology degree prepares them for. Previously students could go through the entire program not really knowing what biologists actually do. Students starting at SJSU as Freshmen and intending to major in one of the sciences are encouraged to take a recently developed course, Success in Science (Science 2), that ensures they have study and personal organization skills necessary for success in our undergraduate programs.
Too frequent instances of improperly disposed biohazard waste and uninformed behavior in teaching laboratories Biological Safety (Bio 6) is a 1-unit course that has recently been introduced as a course required of every biology student prior to taking an upper division laboratory course with the intent that students will be better prepared to work safely in our teaching laboratories, our research laboratories, and in their future academic or industrial laboratory settings.

Forensic Entomology (Ent 106) was recently established to serve students in the Justice Studies Department and biology students interested in forensic science. The biology department worked closely with Justice Studies (which hosts the program) to develop the forensic science concentration and teaches many of the courses required by students in this important and popular new curricular area.

Introduction to Bioinformatics (Bio 121) and Bioinformatics (Bio 221), and Bioinformatics I and II (Bio/CS 123A and 123B) have all been introduced in 2001 and 2002 and have been taught each year since then. Respectively, these courses provide bioinformatics instruction at the undergraduate and graduate levels in the biology department, and at the undergraduate level for students in computer science or at least some skills in computer programming. Molecular Biology for Computer Scientists (Bio 23) was developed at the same time to serve as a bridge course to allow computer science students interested in bioinformatics to have an introductory molecular cell biology course tailored to the needs of study in bioinformatics. A similar course, CS 23 provides biology students with an overview of computer science and Perl programming in preparation for the interdisciplinary Bio/CS 123 series.

In response to the current and continuing acute shortage of clinical laboratory scientists in California hospitals, the department initiated a new masters-level program, the Clinical Laboratory Scientists licensure program. Two new courses, Field Work in Clinical Laboratory Science (Micro 291) and Topics and Demonstrations in Clinical Laboratory Science (Micro 292) have been developed and other existing courses have been included as requirements for this specialized program. The program is currently operating at near capacity levels.

Inspired by discussions with the Sloan Foundation, the department has initiated a novel interdisciplinary degree program, the Masters of Biotechnology (MBT). The program provides master’s level coursework in both biology and business, creating graduates able to work at the interface of biology and business, in management positions in the biotech industry and in related positions in regulatory affairs or intellectual property. The self-supporting program required several new courses to be developed to be offered through special sessions including Graduate Studies in Biotechnology (Bio 202T), Advanced Molecular Techniques (Bio 205T), Bioinformatics (Bio 221T), Individual Studies [Internship] (Bio 280T), and Colloquium in Biological Sciences (Bio 285T).

4. Program Quality and Advising
Advising is a valuable component of our undergraduate and graduate curriculum. Currently, all graduates have a single major advisor, whether they are thesis students
(MS; Plan A) or non-thesis students (MA; Plan B). Undergraduates are assigned an advisor based on their particular concentration or type of bachelors degree and have access to additional specialized pre-professional advisors. All faculty normally have four hours of office hours each week, often with more by appointment. Students have ample access to faculty advisors and mentors.

We have over the years tightened our advising strategy to ensure that fewer students ‘drift’ through any of our programs, performing poorly and arriving in their senior year without the ability to graduate or with only the ability to graduate only by the skin of their teeth. All undergraduate students earning lower than a solid “C” grade in our majors’ core courses (Bio 1, 2 & 3) are required to see an early intervention advisor who helps the student examine their organization and study skills, and discuss their personal and career goals, and perhaps even re-assess their choice of major. Prerequisites are strictly enforced throughout the department, ensuring students are at least nominally prepared for courses they take. Academically disqualified students are counseled and required to work with an advisor to develop a contract for their return to good standing. Students are allowed to repeat courses only once. All of these, taken together, have perhaps reduced our number of majors but have effectively increased the quality of our graduates and ensured a more rapid time to graduation for those for whom a major change may be in order.

5. Assessment

While there has been a national trend toward the adoption of formal assessment plans at all levels of academic organizations, our department believes that structured program assessment must be developed and implemented advisedly. Academic institutions have maintained high quality over the years by relying on the professionalism that can be expected from faculty committed to their disciplines. The collegial environment and shared governance of academic departments and institutions exerts a correcting force on substandard teaching and programs and provides strong incentives for cultivating teaching and programmatic excellence. The choices available to students in selecting a university, a department with which to be affiliated, and instructors from whom to take courses provides the competitive milieu that further motivates faculty to design and deliver the best curriculum for their students. While it may not be sufficient to rely on the instinct, intuition, observation, and professional judgment of professors individually and collectively, it is an essential — perhaps the essential — element of programmatic quality.

Our department has initiated a broad array of formal assessment procedures to supplement the data obtained by personal observation by individual faculty in their courses. We have identified seven major ‘outcomes’ that we seek for all of our students. They are as follows:

- mastery of the content of the core concepts of biological science
- mastery of the content of required upper division courses in the academic program
- mastery of fundamental biological laboratory/field skills
- competence in the acquisition, assimilation, integration and use of information
- ability to work effectively in groups to solve scientific problems
• competence in written communication of scientific information
• proficiency in oral communication of scientific information

We assess each of these learning objectives in almost every course through the use of assignments and exams, allowing a reinforcement of the skills throughout a student’s college career. And we have entire required courses devoted to some of these learning objectives where we deem our students are in particular need of instruction and practice.

We have designed our departmental assessment strategy to address each objective with consistency that allows comparison across courses and between cohorts over the years. Specifically, we have identified courses in our curriculum in which each objective is either introduced, developed, or culminated and selected courses from these in which assessment of competency will take place. Common exams or scoring rubrics will be used to facilitate measurement of progress toward reaching each objective as students move through the program and measurement of changes in achievement by our students at each class level over the next five to ten years. Assessment of each program objective is described below:

• We have begun administering the Educational Testing Service’s Major Field Test in Biology to our graduating seniors to assess their knowledge of core concepts in biology; the test resembles the Graduate Record Exam and provides us with student subcores in (1) cell biology, (2) molecular biology and genetics, (3) organismal biology, and (4) population biology, evolution & ecology. We give it to a sample of students just finishing the biology core (in Bio 4) and will give to a sample of graduating seniors (in Bio 144, a course that is taken by graduating seniors that provides an opportunity for students to have a common culminating experience). This exam gives us a way to compare our graduates to those of other universities and allows us to measure the change in our students during the time they are with us.

• We have designed and begun administering program-specific exams of content knowledge using exam questions from each program’s required upper division courses. These exams allow us to assess the success of courses in our programs to instill our majors with a lasting understanding of subdiscipline-specific concepts. These exams are given to graduating seniors and a sample of students just finishing the biology core to allow longitudinal comparisons to be made.

• Laboratory/Field skills have only begun to be assessed systematically. The plan is for students in the core (Bio 1, 2 & 3), Mammalian Physiology (Bio 125) or Vertebrate Physiology (Bio 126), Molecular Cell Biology (Bio 135L), Ecology (Bio 160 or Bot 160), Advanced Molecular Techniques (Bio 205); Pathogenic Microbiology II (Micro 142L) and Fieldwork in Clinical Laboratory Science (Micro 291) to participate in one lab/field experience each in which an evaluator records the quality of students’ lab/field behaviors using a common rubric.

• Information competence has also just begun to be assessed systematically. The plan is for students in Scientific Communication (Bio 100W) and Graduate Studies in Biology
(Bio 202) to take an online test based on the Academic/Research Librarians information competency standards near the end of semester. All biology undergraduates and graduate students take one of these two courses; mastery is expected upon the completion of either of these courses.

• The ability to work in groups to solve problems has not yet begun to be assessed. We plan to begin by assessing students in Evolutionary Genetics (Bio 118), Evolution (Bio 218) with rubrics for group process and product quality based on both critical thinking criteria and success of calculations. Assessment of this learning outcome in other courses will be phased in over the next five years.

• Proficiency in written communication will be assessed for students’ demonstrated proficiency in writing with clarity, conciseness, and coherence about relationships among biological concepts. The introduction that students write for a required term paper in Scientific Communication (Bio 100W), Graduate Studies in Biology (Bio 202) and Topics and Demonstrations in Clinical Laboratory Science (Micro 292) will be evaluated using a common rubric.

• Proficiency in oral communication – the ability to give a concise, clear, organized oral presentation, with responses to questions and leadership for the audience – will be assessed using common rubrics in Animal Biology (Bio 2), Evolutionary Genetics (Bio 118), Mammalian Physiology (Bio 125) or Vertebrate Physiology (Bio 126). 218; Micro 292 will give oral presentations on literature searches/ lab results (assessed with rubrics).

The data gathered from each of these assessments will be consolidated, analyzed, and presented in a written report given to the Chair and each department faculty member as the data becomes available, ideally near the end or start of each year. These data will be combined with recommendations we receive from our department’s external advisory committee (see appendix), exit surveys of graduates, and surveys of program alumni and Bay Area employers to provide a sufficiently nuanced data set to suggest actions the faculty, areas, or the department as a whole might want to take. Formal curricular changes will be initiated, reviewed, and enacted by the usual department procedures.

6. Facilities
The curricular programs in the Biology Department are dependent on a remarkably complex and overextended physical infrastructure. The eight floors of the south wing of Duncan Hall house nine service areas – a greenhouse, an animal housing facility, a physiology and microbiology service center, a molecular cell biology service facility, a computer services area, an electronics shop, a microscope shop, a chemical support area, and an anatomy facility. In addition to these our courses depend on core facilities stocked with sensitive and expensive instrumentation, sufficient, stable and uninterrupted power, highly purified water, readily accessible natural gas, adequate laboratory fume- hood ventilation, centrally delivered carbon dioxide, regular shipments of dry ice and liquid nitrogen, tight regulation of ambient temperature, up-to-date computer labs, servers and software applications, fast and reliable internet access, vans for shuttling students to the field study sites, multimedia audiovisual equipment and supplies, a functioning
electron microscope and support equipment, autoclaves and high-volume dishwashers, clean rooms with laminar flow hoods and incubators for tissue culture, dedicated cold rooms, flow cytometer, DNA sequencer, and high volume cell processing equipment.

Over the last five to ten years many of the critical areas of need have been addressed – installing back-up power, improved internet access, improved water purification, and replacement of autoclave and dishwasher – and some enhancements have been made – the purchase of the flow cytometer and other molecular cell biology instrumentation and the upgrade of computer labs and servers. Still, all of these systems require maintenance and eventually replacement for their continued dependable service to and support of the curriculum. Maintenance, let alone enhancement, of the quality of department programs depend on continuing campus commitment to adequately funding these facilities and instrumentation. As a department and individually as faculty we apply for external funding wherever possible to support equipment and computer purchases. Funding agencies are generally not interested, however, in doing what they feel is the university’s role of maintaining equipment and upgrading infrastructure. Our program plans’ each include the necessity of maintaining and upgrading infrastructure and instrumentation as critical components to maintaining program quality.

7. Enrollment & Instructional Capacity
Our efforts to address the issue of declining enrollments in department programs – most acute between 1995 and 2000 – have paid off over the last five years with steadily increasing numbers of full-time equivalent students (FTES). We recruit students during new-student orientation and other events where students look for information about majors. We have a department website designed in part for effectiveness in student outreach. Our department office staff takes pride in providing friendly and helpful service to students. We have implemented proactive advising policies to improve retention of students likely to succeed in the major. We have enhanced our graduate course offerings and number and diversity of graduate programs. And have continued to focus on maintaining the quality of our curricular programs, particularly by commitment to laboratory-based instruction and by maintaining our high expectations of our students. Students notice the quality and rigor of our programs and, by and large, are drawn to that.

The continued strength in the life science sector over the last five years, particularly in the biotechnology and healthcare industries, while the information technology sector was contracting, has also not been missed by our students. They see that there is a continuing need for well-trained life scientists and that the satisfying, well-paid jobs are open to graduates of our program. Our challenge now is to manage enrollment to optimize program quality. When enrollments were declining we improved student outreach and retention efforts. Now that enrollments appear to be outpacing our ability to accommodate students, we are doing what we can to expand our student capacity. We now run more courses close to their enrollment maximums, open more sections, and hire more temporary teaching staff. We are always willing to consider procedures that can make our curricular programs more efficient while maintaining their quality. Particularly, we strive to include best practices in our courses to ensure that students are learning as effectively as possible. Many best practices, however, such as giving
meaningful feedback on writing, or assigning problems and evaluating student solutions, are inherently faculty time-intensive. And while we use teaching associates, graduate assistants, and course assistants where appropriate and when such assistance is available, the vast majority of teaching and student feedback falls to program faculty.

A major element of program planning is for members of each program to look to the future and ask, What changes in program conditions can we expect in the next five years? For many programs the answer to this question included the expected loss of faculty teaching in the program to retirement. While planning to hire new faculty to meet increasing enrollment is justified, replacing faculty teaching essential courses in our programs is a critical need. Our department once had 50 full-time faculty for 2/3 the number of students. We now have 30 full-time faculty and 3 regular part-time faculty members. Specific faculty hiring plans are described in the self-studies of each program. While some are proposed to contribute to growing programs, others are proposed to replace retiring faculty who make critical contributions to the program.

We are committed to providing our undergraduate students with a well-rounded biological education, with faculty members and courses in cell biology, molecular biology and genetics, anatomy and physiology, organismal biology, population biology, evolution & ecology. Though reductionist biology may currently offer more employment opportunities, systems biology, conservation biology, and evolutionary biology are clearly subdisciplines of critical importance for America in the 21st century.

We also are committed to providing our students with instruction and research opportunities in cutting-edge fields such as immunology, bioinformatics, cell biology, genetics and virology. Retirements of primary instructors and/or burgeoning enrollments in these areas call for the hiring of new faculty in these subdisciplines of biology.

The sections of our 2005-6 self study and program planning document that follow focus on each of our degree programs and concentrations within those. As required by the program planning policy S01-5 of the Academic Senate of SJSU, we address the following issues in each program's self study: (A) centrality of the program to the fulfilling the mission of SJSU, (B) the quality of the instructional program, (C) student demand for the program, (D) societal need for the program, (E) Financial resources, (F) interdependence of the program with other programs on campus, (G) Capacity to contribute to the academic field, (H) the availability of instructional alternatives, and (I) outline of program plan for the next five years.
BA – Biological Sciences

Course Requirements

General Education Requirements
Of the 51 units required by the university, 12 may be satisfied by specified major and support requirements. Consult major advisor for details.

American Institutions
Of the 6 units required by the university, all may be satisfied within general education requirements as specified in the schedule of classes.

Physical Education

Preparation for the Major
CHEM 001A and CHEM 001B (10); CHEM 008 and CHEM 009 (4); CHEM 135 (4); PHYS 002A and PHYS 002B (8);
BIOL 005 and BIOL 155 (6); BIOL 100W (3) (Geol 1, Geol 1L recommended but not required.)

Requirements in the Major
BIOL 031, BIOL 002, BIOL 003, BIOL 004, BIOL 006 and BIOL 115 (18); BIOL 116, BIOL 117 or BIOL 118 (3); BIOL 160 or BOT 160 (4); MICR 101 (4)
BIOL 124 and BIOL 126 (4) or BOT 102 (4)
Upper division biology electives chosen with prior advisor approval
Other science electives from within or outside the College of Science, chosen with prior advisor approval

Total Units: 123

A. Centrality to Mission

A. Statement of Mission and Goals of the Program
The BA in Biological Sciences is designed for students who do not necessarily want to specialize in a specific sub-discipline of biology, but who desire flexibility in their curriculum or in their career choices. This degree affords opportunities in a variety of entry-level jobs, and is a steppingstone to graduate and pre-professional programs. Students preferring to specialize in a sub-discipline of biology can elect to complete one of our BS programs including: Molecular Biology, Systems Physiology, and Conservation and Organismal Biology. The BA in Biological Sciences relies on faculty and courses from the BS programs. In doing so, it provides breadth in biology and allows students to tailor their degree to their interests and goals. It can truly be considered a “general” biology degree.

The program’s mission is to provide students with a strong, broad-based biology education with an emphasis on practical, career-relevant skills. The program is flexible enough to allow students a number of career and advanced study choices. In addition to specific lower division and upper division required courses, students must take at least 6 units of upper division biology electives and are allowed at least 8 units of other electives within or outside of the College of Science. Thus, students can tailor the curriculum by choosing among a variety of upper division biology electives, or by choosing a portion of their electives within or outside the department or even outside of the College of Science. For example, a student intending to pursue a sales career may take marketing or finance
courses, or a student interested in a liberal arts education may take humanities courses. Or, they may choose to pursue all biology electives that cut across the boundaries of the BS programs. Elective programs are selected in consultation with a faculty advisor (see Fig. 1 for a flow chart of the area requirements).

Figure 1. Required Courses for the BA in Biological Sciences.

The program aims for students to develop a solid foundation of biological knowledge and laboratory skills. We provide many methods for students to develop strong quantitative, problem-solving, critical-thinking, communication, and computer skills. The program’s curriculum is designed to meet these objectives. For example, in the lower division “core” courses, students acquire basic knowledge about plant, animal, and cell biology, and the associated laboratory techniques. They build on this knowledge and these techniques in upper division courses addressing genetics, botany, physiology, zoology, microbiology, and ecology.

Over the past few years, we have incorporated into this program some required courses that address topics related to biology. For example, students learn about biology careers in Professions in Biology (Bio 4). They learn research-related computer skills in Computer Literacy in Biology (Bio 5), and apply them when learning experimental design and statistical analysis skills in Hypothesis Testing (Bio 155). They write and speak about biology in Scientific Communication (Bio 100W). There are also a variety of chemistry and physics courses that these majors take to prepare for or supplement their biology coursework.
This program makes students informed consumers of scientific information, allows them to understand modern biological discoveries (such as in biotechnology), makes them aware of environmental and conservation issues, and allows them to explain all of these types of information to colleagues and laypeople. Students who complete this program can build upon what they have learned in their jobs and in advanced study.

B. Quality of the Instructional Program

1. Curriculum

The breadth of the BA in Biological Sciences is its main strength. This breadth takes the form of subject matter and assessment methods. Students gain subject knowledge and laboratory skills in a variety of fields. They gain practical experience with computers, problem solving, working in groups, critical thinking, experimental design, computerized statistical analysis, and communication. We believe that all of these skills prepare students to be “biologists in the real world.” Most importantly, the BA program relies heavily on the integration of courses from our other program areas, hence their strengths become the BA Biological Science area's strength. Such qualities include a high number of field experiences in the Conservation and Organismal area, biotechnology hands on experience in the Molecular and Microbiology areas, and attention to detail in pre-laboratory activities for the Systems Physiology area.

2. Teaching

Our faculty members have been trained at excellent academic institutions in the US, and bring excellent teaching and research skills to SJSU. Student ratings (SOTES and SOLATES) for courses in this program are consistently above SJSU’s average (Table 1).

Table 1. Dept. of Biological Sciences Overall Student Approval Based on Student Opinion of Teaching Effectiveness (Based on data collected for AY 2003).

<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Mean Score (out of a maximum of 5)</th>
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<tbody>
<tr>
<td>Made Course Requirements Clear</td>
<td>4.3</td>
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<tr>
<td>Collected Enough Information to Assign Grades</td>
<td>4.3</td>
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<tr>
<td>Used Fair and Impartial Grading Methods</td>
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<tr>
<td>Increased my Understanding of the Subject</td>
<td>4.3</td>
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<tr>
<td>Was well Prepared for the Class or Activity</td>
<td>4.3</td>
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<tr>
<td>Used Class or Activity Time Effectively</td>
<td>4.2</td>
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<tr>
<td>Helped me Apply Theory or Concept to Class Activity</td>
<td>4.1</td>
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<tr>
<td>Showed Concern for Students</td>
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<tr>
<td>Helped me Learn the Material</td>
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<td>Provided Individual Assistance as Needed</td>
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<td>Demonstrated Proper &amp; Safe Use of</td>
<td>4.4</td>
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</table>
Equipment or Technique Demonstrated or Explained Technical Skills as Necessary Was Accessible to Students During the Class Activity The Overall Effectiveness of Instructor

3. Strengthening program quality
The faculty contributing to the BA in Biological Sciences use many assessment methods addressing various learning styles. In revisiting our past program plan (2000-2001) a number of proposals were made. Below we summarize these proposals and address our progress with each.

1. Implement formative assessment and summative evaluation of the learning objectives and skills for the lower division core and upper division curriculum, respectively. The department has implemented this strategy by testing incoming students in our lower division courses for formative assessment and by testing graduating students via a standardized exit exam, the Major Field Test in Biology, produced by the ETS. A small sample of students was assessed during spring 2005 and results are given in Appendix 11. The plan is for this exam to be given every semester to students in Biology 4 as a baseline exam and in Biology 144 as an exit exam. Additionally, an assessment exam of multiple-choice and essay questions specific to different courses that students in the BA program take has been written and will be given to students in the same courses as the ETS Major Field Test. See Appendix 12 for baseline results obtained with this assessment tool.

2. Request evaluations of our graduates from employers, graduate schools, and health profession schools. At this point, no effort has been made to pursue this proposal. Although gathering this type of data is not impossible, we must depend on others to provide data for us that may be both spotty and difficult to obtain. Upon reconsideration, our resources can probably be used more effectively in other areas. Some of this information is obtained, albeit anecdotally, from members of our external advisory board. See Appendix 20.

3. Seek feedback from former student graduates who have been out of school (and hopefully employed) regarding our program. This proposal also has not been pursued for reasons outlined above. Still, we have generated a survey of our alumni that will help us begin to get this kind of information. See Appendix 19.

4. Seek feedback from students via an exit survey upon graduation. This can be implemented at the same time that graduating students take their exit examinations. Our graduate exit survey provides a standard vehicle for some of this kind of information to be gathered and could be expanded as necessary. See Appendix 18.

5. Development of a program portfolio containing course exams, assignments and greensheets that will be used to develop flow charts to ensure that performance
outcomes are met in the program. Produce spreadsheets indicating which courses address specific program goals and outcomes. The prior program plan outlined a number of learning outcomes and assessment techniques to determine how well our courses meet our objectives. The General Education Area faculty responsible for the BA compiled course greensheets and monitored courses to chart whether they address specific learning outcomes and how their course content is assessed (See Figure2).

4. Looking to the Future
The department has recently redefined student learning objectives outlined above and placed additional information on the Internet: http://www2.sjsu.edu/ugs/PA/pa-Biol.htm. Moreover, a new assessment plan with specific goals and timeline for the department as a whole is outlined below:

Student learning outcomes’s assessed for review Fall 2005

- Students will be able to apply the five ACRL (Association of College / Research Librarians) standards for information competency in an exam given in two courses taken by all undergraduates and all graduate students, respectively: Biol 100W and in Biol 202.
- Students will demonstrate knowledge and comprehension for basic concepts in biology across all biology programs.

Direct measures collected:

- Information competency data will be collected from about 100 students in four undergraduate and one graduate course (Biol 100W, Biol 202) by the end of this semester. Students will demonstrate proficiency in identifying a research problem given a topic (Std 1), locating valid internet sources (Std 2), paraphrasing information from these sources (Std 3) with appropriate citations (Std 5), and linking new knowledge to prior knowledge to construct and apply knowledge (Stds 3, 4) in an on-line exam.
- Data has been (starting Spring ’05) and will continue to be collected from students who take an exam (ETS + program-specific questions) at the end of each semester. A number of semesters of data collection will be needed before enough students have taken the exam to generate meaningful conclusions.

Summary of data:

- The information competency data will be evaluated by Spring 06 by a faculty member (Dr. Hyde).
- The knowledge-comprehension data is being evaluated by faculty members representing the different programs in biology.

Findings: To be reported in Spring 06.
Actions taken: To be reported in Spring 06.

Spring 06 data collection & calendar. Student learning outcomes to be assessed:

- Students will demonstrate knowledge and comprehension for basic concepts in biology across all biology programs (ongoing for several semesters).
- Students will demonstrate proficiency in written communication by writing with clarity, conciseness, and coherence about relationships among biological concepts (Spring 06).
- Students will demonstrate skills in the laboratory as they engage in regularly-scheduled lab activities that include basic skills, acquired in previous courses, as well as advanced skills (Fall 06).
- Students will demonstrate proficiency in oral communication by giving concise, clear, and organized oral presentations, with responses to questions and leadership for the audience (Fall 06/ Spring 07).
- Students will demonstrate ability to work effectively in groups on critical thinking while participating weekly on problem-solving activities and reporting their results to the class (Fall 06/ Spring 07).

The area feels that we must strengthen our effectiveness as advisors of our students. As the BA is a flexible degree and provides many possible career paths, we must be aware of different opportunities to optimize our effectiveness as advisors. Areas of concern may focus on creating standards for advising, ensuring mandatory scheduled advising sessions with students take place, and the developing of specific career tracts within the BA.

Finally, the need for new faculty hires must be addressed. With student/faculty ratios jumping from 14 to 20 in four years and no fewer than three faculty members retiring in the next five years (Kutliek, St. Omer, Matson), our overall quality as a department will suffer greatly. These faculty play key roles in teaching and advising in the BA area and teach Ecology (Bio. 160), which is a BA requirement. Moreover, they are vital in General Education instruction, and also teach courses in the Biology Core which is required of all biology students. Coincidentally, all of these faculty members also teach in the Conservation and Organismal area and it is recommended that the department focus its resources on hiring at least three faculty members with expertise in this area.
### Figure 2: Student Learning Objectives and Assessment Strategies for Selected Courses in the BA Program (2001-2004)

<table>
<thead>
<tr>
<th>Course</th>
<th>Assessment</th>
<th>Short Answer Questions</th>
<th>Essay Questions</th>
<th>Problem Solving Questions</th>
<th>Calculations</th>
<th>Journal Examinations</th>
<th>laboratory Examinations</th>
<th>Other</th>
<th>Short Answer Questions</th>
<th>Essay Questions</th>
<th>Problem Solving Questions</th>
<th>Calculations</th>
<th>Journal Examinations</th>
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<td>Bio. 119 (Mammalian Physiology) Laboratory</td>
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C. Student Demand.

A limited amount of data has been collected to analyze student demand from 2001-2002. During this time, roughly 30% of all the biology degrees conferred at San Jose State were in the BA area and this represents the largest number of degrees from any area within the department (Fig. 3).

Figure 3. Number of Degrees Conferred for Each Department Area for 2001-2005.

Although enrollments have increased in the past few years overall in the Department of Biological Sciences, they have decreased significantly in the BA area in the past few years (Fig. 4). This change may be due to incoming students declaring a specific concentration early within the department. Another interesting point in the enrollment data shows that the area has maintained a fairly high number of juniors and seniors in the BA area which may be the effect of incoming transfer students from other institutions and a number of students from other majors who decide to declare a BA in the biological sciences. One concern is that for all years examined, B.A. the area does not appear to be effective in maintaining its number of incoming freshmen as the number of sophomores appears to consistently decline in succeeding years.
Figure 4. BA Biological Science Student Enrollments 2000-2004.

Many of our students want the flexibility of the BA and do not want to be locked into a BS concentration with few electives and almost none outside biology. In addition, those students who discover they do not have the interest or the skills to pursue one of our more lab intensive concentrations often move into the BA. Our department is taking steps to make students more aware of the boom in the biotechnology field. BA students are in high demand for positions in sales, marketing, and technical support.

D. Societal Need for the Program

Biologists fulfill many of society's needs in K-12 education, higher education, science industries, medical industries, private businesses, government agencies, and health fields. Children and college students need biology educators and California is currently experiencing a shortage of math and science teachers. Science industries, medical industries, and private business need entry-level workers with biology knowledge and lab skills. Biotechnology will undoubtedly continue to rival information technology as a leader of scientific discovery. Biologists are needed to work in the laboratories, quality control departments, and sales forces for biotechnology firms. Many of these positions do not require the specialization provided by our BS degrees. In fact, we have heard from biotech employers that they prefer to hire broadly trained biologists for sales and marketing positions rather than business majors. Government agencies need biologists to conduct research, write reports, disseminate information to the public, communicate with
politicians, and participate in decision- and policy-making. Biologists are needed in
many health fields such as hospital administration, health insurance, and the medical
professions. Moreover, it is imperative for the area to keep the curriculum fresh, current,
and interesting for students, by addressing areas of biology that impact our lives today.
This includes introducing such topics as evolution education, stem cell biology, species
diversity, bioinformatics, and forensics.

E. Financial Resource Effectiveness, Viability, and Efficiency

This program primarily receives funding for its courses from the budget of the
Biological Sciences Department, which is allocated by the Dean of the College of
Science. The base budget is relatively stable and is supplemented by funds that are
proportional to FTES. The department also gets income from lab and field fees and
Continuing Education for regular and, to a lesser extent, special sessions. Faculty
members also write grant proposals for laboratory upgrades to private and public
agencies. Faculty members acquire research funding from private or public agencies, and
some faculty support undergraduate and graduate students using this research funding.

The department also receives equipment and supply donations from private industry.
Most of these donations come to us because of our students who work in industry. When
a company is retooling and getting rid of supplies or equipment, our students give us a
call.

All the sources above, except the base budget, are variable and are dependent on
FTES, the economy, or the extramural funding climate. Funds from grants and donations
are sporadic at best.

Because the curriculum for the BA draws from our other concentrations, it is difficult
to do a specific resource analysis for this concentration. The heart of the BA and most of
our concentrations includes the Biology Core (Biology 1, 2, and 3), Biology 5 (Computer
Literacy), Biology 6 (Biosafety), Biology 100W (Scientific Communication), Biology
155 (Hypothesis Testing), Biology 115 (Genetics), Micro 101 (General Microbiology),
Biology 160 (Ecology) and a physiology course (Biology 102 or 124 and 125 or 126).
Many of these courses have laboratories that require a significant investment in supplies
and equipment. In addition, to keep our programs current, equipment must be upgraded
frequently. Much of this cannot be done with the present base funding so we either get
by with outdated equipment or seek funds elsewhere.

Our major resources are derived from funding based on FTES which has declined
significantly from just over 50% of the total department's FTES to around 20% in 2004 as
the number of BA Biological Science majors has decreased (Figs 4-5).

This loss had a very negative impact on our curriculum because our laboratory-
intensive programs are very expensive and cannot be supported solely by the base funds
provided to Colleges or by the FTES generated by majors alone. In the past, we have
relied on secondary FTES, mainly from GE, to help us upgrade our equipment and
support the small labs that are essential to a quality undergraduate and graduate science
curriculum. We have sought and are aggressively seeking external support through
grants and from private industry, but these sources of funding are erratic at best. Our
molecular biology program has fared much better than other areas because of the
university's commitment to enhance this program and the increased funding that has
resulted.
Our goal is to try to build a diversified funding base that includes but does not exclusively depend on base funding and FTES. As part of this goal our department continues to seek extramural grant funding, but in addition is trying to establish relationships with private industry, including collaborations and special educational programs that can bring resources to the department.

Resource stability is highly dependent on FTES. The decrease in FTES over the last five years has put a significant strain on our programs. A further decrease would begin to significantly impact the quality of our programs and our ability to offer our students state-of-the-art courses.

F. Interdependence of Programs

Our faculty are organized into areas which include Anatomy and Physiology, Molecular and Microbiology, Conservation and Organismal, and General Education. Each area serves a number of different programs. As an integrated, general program, the BA in Biological Sciences relies on faculty instruction from all of the department’s areas and programs. The BA curriculum does not serve other majors in the University to a large extent. Biology 5 (Computer Literacy in Biology) and Biology 155 (Hypothesis Testing) serve students in the Environmental Studies Program. The prerequisites for some of the program’s courses depend on the Chemistry, Physics, and Math departments.
G. Capacity to Contribute to an Academic Field

The faculty involved in the BA in Biological Sciences makes diverse contributions to their academic fields. They write successful grant proposals to government and private agencies, present abstracts at scientific meetings, publish in scientific journals, and establish contracts with governmental agencies and private industry. A breakdown of faculty accomplishments of 15 faculty members who contribute to the area can be found in Figure 5. Additionally many also collaborate with colleagues at other universities (such as UC Berkeley, UC Santa Cruz, UC Riverside, Stanford, and Cal State Hayward), governmental agencies (such as NASA-Ames Research Center, California Fish and Game, California State Parks), and private industry (such as Becton Dickinson). Undergraduate and graduate students are instrumental for successful faculty research as they help to collect and analyze data, and often are authors on abstracts and publications.

Figure 5. Selected Faculty and Contributions to Their Academic Fields.

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<tr>
<th>Faculty</th>
<th>Area</th>
<th>Scholarly Activities (2001-2005)</th>
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<td>Published Papers</td>
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H. Availability of Instructional Alternatives

As the fifth largest metropolitan area in the country with over 7 million people, the San Francisco Bay Area possesses a number of four-year colleges in addition to San Jose State University that confer general biology degrees and include large universities such as Stanford University, Santa Clara University, U.C. San Francisco, U.C. Santa Cruz, UC Berkeley, Cal. State University East Bay, and San Francisco State University; however, our program remains unique to the region. Although both Cal. State East Bay, and San Francisco State offers a BA in biology, their students are required to take all electives
within their respective biology departments. Only our program offers a general bioscience degree that allows the flexibility to take courses outside of the biology department. The question remains how to maximize our program’s uniqueness. Input from advisory groups, industry, and perhaps other departments within the university should be solicited. More visibility on the Biological Sciences website should also be explored.
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INQUIRY
CROSS-DISC.
BA in Biological Science, Preparation for Teaching

Course Requirements

General Education Requirements
Of the 51 units required by the university, 15 may be satisfied by specified major and support requirements. Consult major advisor for details.

American Institutions
Of the 6 units required by the university, all may be satisfied within general education requirements as specified in the schedule of classes.

Physical Education
Preparation for the Major and Supporting Courses
CHEM 001A, CHEM 001B and CHEM 008 (13); PHYS 002A and PHYS 002B (8); BIOL 005, BIOL 155 and BIOL 100W (9); GEOL 103 (3); GEOL 001, GEOL 105, METR 112 or ASTR 101 (3); SCI 108, SCI 110 and Sced 175 (4); PHIL 133 (3)

Requirements in the Major
Botany 102 may satisfy only one requirement.
BIOL 001, BIOL 002, BIOL 003, BIOL 004, BIOL 006 and BIOL 115 (18); BIOL 160 and MIRC 101 (3); BOT 102, BOT 103, BOT 105 or BOT 165 (4); ZOOL 115 or ENT 101 (4); ZOOL 116 or ZOOL 160 (3-4)
BIOL 124 and BIOL 126 (4) or BOT 102 (4)

Electives

Total Units: 123

A. Centrality to Mission

Goals of the Program
The subject matter preparation for this credential requires a year of college level work in four areas of science: biology, chemistry, geoscience and physics. The year of geoscience is not common in biology degrees. This science diversity is considered background for teaching general or integrated science. A course in integrated science (Science 110 to be offered in Fall 2006) is unique to this biology degree.

The other variances from the BA in Biological sciences are: requirements for separate courses in vertebrates, invertebrates and botany at the 100-level, and the omission of a second genetics course and biochemistry. The omissions were approved by the Biology Department, primarily because they could not be required within a 124 unit limit.

From its inception in 1857 as a “Normal School”, SJSU has prepared teachers for California Schools. Preparation of graduates for the workforce, including teaching is still central to the SJSU mission.

Program Contributions to the Mission of SJSU
The mission of SJSU is “to enrich the lives of its students, to transmit knowledge to its students along with the necessary skills for applying it in the service of our society, and to expand the base of knowledge through research and scholarship.” This major is designed to meet both the degree requirements of the Department of Biological Sciences, and the California Commission on Teacher Credentialing standards for the subject matter preparation for a California Teaching Credential in Science: Biological Science for grades K-12. Successful graduates of this degree and a credential program may teach any science in middle school or biology and general or integrated science in high school.
B. Quality of the Instructional Program

This major is unique in the CSU system in that it requires a full year of instruction in each of the four major science fields (Biology, Chemistry, Geosciences, and Physics). In addition, starting in Fall 2006, a new course will be required, Science 110. This is an integrated science course that will fulfill the California Commission on Teacher Credentialing standards for the subject matter preparation for a California Teaching Credential in Science.

Quality of courses not specific to the program is dependant on faculty throughout the college. In general tenure and tenure track faculty are course lecturers, and often laboratory instructors as well. In general, the program closely follows the curriculum offered for the BA-Biological Sciences.

The program provides strong preparation for future middle school and high school teachers in science and particularly biology. Because of the expected continued high demand for new science teachers we have the opportunity and obligation to make this program grow.

The best indicator of instructional quality is the teaching effectiveness of the graduates in science classrooms in CA schools. There are local school districts that for years have sought our graduates. This bias must be unofficial, and so is not documented directly. This is no longer a true indicator since districts far less often have much choice in who they hire with the lack of prepared teachers.

The BA-Biological Sciences, Preparation for Teaching is a credible biology degree with an organismic tilt. Its graduates are well prepared to teach high school biology. Students who opt not to go into teaching find that this degree allows them to proceed to advanced degrees.

C. Student Demand

Since the last program planning in 2000, ten students graduated in this major. All of these students were accepted into the Single Subject Credential Program and received their teaching credentials. At any one time, there are about 20 BA-Biological Science, Preparation for Teaching majors. The number remains about the same from year to year. A misperception of the numbers is likely because the advisor for this major is usually advising other biology majors as well since some students prefer to earn another degree while preparing to become teachers. In fact, in the same time period, ten BA-Biological Science students entered the Single Subject Credential Program and received their teaching credentials. Several students indicated that they preferred the BA-Biological Sciences because the diploma does not refer to “teaching”, which they perceived to be an “education” major. The advisor for pre-service teachers often advises students from other “biology” concentrations as to the requirements to enter the Single Subject Credential Program in Biology.

It seems reasonable to assume that we graduate from 2 to 5 people in this program each year, and that there are at least 20 students are actively pursuing the major. Far more students are juniors and seniors since many of these students are transfers, primarily from local community colleges. Thanks to the publicity about the need for teachers some freshmen are now opting for this major upon admission.

The demand for science teachers far exceeds our production of them. In the last 5 years newly credentialed teachers have been able to find teaching positions with a full load of biology courses. This indicates that the there is still a substantial need for Biology Teachers. So our task is to increase the student demand for the program to close this gap. There is some indication that the student demand is up, but not nearly far enough.
D. Societal Need

There has always been a need for science teachers in the public schools. Given current global, national and local environmental and resource issues it would be possible to present a long dissertation on the societal needs for the public to be informed about the biological sciences. In addition, locally and nationally we are facing an exaggerated need for new teachers to replace those retiring in large numbers, and to work with a growing student population.

SJSU credentials students who have done their science preparation at SJSU as well are sought after by local school districts to fill teaching positions. There is a reputation to uphold, which many of our students recognize. Our emphasis on laboratory experiences and fieldwork is especially helpful as a model for teacher candidates.

E. Financial Resources, Viability, and Efficiency

Since no resources are designed specifically for this program this is a difficult topic to address. Most courses in the major are funded by all of the departments within the College of Science. It is estimated that one-third to half of the enrollment in Zoology 115, 116 and 160, and Botany 102 are students in this program. While some funding for course development and revision have come from outside sources (NSF, CSP, private foundations, and local businesses), most of these endeavors are supported by the individual departments and/or the College of Science. Only two courses are funded via the Science Education Program (Science 110: Global Themes of Science; and, Science 175: Classroom Experiences in Science).

In general, student enrollment appears to be stable or growing slowly. Therefore, resources to meet their needs should remain stable as well. If faculty retirements are not replaced and/or student enrollment increases greatly then the potential exists for diminished capacity in the program.

Since this major prepares students for a career with demands that greatly exceed the supply and the need for more teachers is expected to grow over the next 10 years it is imperative that efforts be made to increase enrollment in this program. Because the courses that make up the program are common to other Biology majors as well as other College of Science majors it appears that some growth can be absorbed with current resources. If growth accelerates it may be necessary to increase the frequency of some upper division course offerings.

F. Interdependence of Programs

All of the courses in this program are general education options, or majors’ requirements in at least one other major. Coordination with this teacher subject matter preparation program and the SJSU Single Subject Credential program allows some of these majors begin the credential program while completing the major.

G. Capacity to Contribute to an Academic Field

The primary contributions are in the academic quality in the middle schools and high schools where the graduates teach. Several SJSU faculty members have research grants that provide research experiences for undergraduates (e.g. the NSF sponsored RUMBA project). This experience is invaluable for prospective teachers who will teach inquiry-based science.

The Science Education Program administers the Masters of Arts in Natural Science. This graduate program is designed specifically for local science educators to engage in scholarly activity beyond their undergraduate degree. Students benefit from the scholarly activities of faculty in the department. Several faculty invite local science teacher to participate in their research, providing fieldwork and laboratory experiences during the summer.

H. Availability of Instructional Alternatives

The lower division elements of this program are available at local community colleges, with the exceptions of one geoscience course. A high proportion of the majors are transfer students.

We have designed the program with course alternatives in vertebrates, invertebrates, and physiology, but these are less useful than it appears since the options in these three areas are offered only once a year and in the same semester for each pair of options.
In addition it is possible to demonstrate subject matter competence by passing a set of CTC approved tests in general science and biology. So some of our majors with other biological concentrations take these tests rather than complete the full set of science courses required for the BA in Biological Science preparation for Teaching. In fact, our program is almost an exact duplicate of the BA- Biological Sciences. With proper advising and selection of electives, a student could easily complete the BA- Biological Sciences with the same “subject matter competency” required by the California Commission on Teacher Credentialing.

I. Program Plan for the Next Five Years
This program should be discontinued as it is not substantially different from the BA Biological Sciences which the majority of students aspiring to become biology teachers choose.
used to resources generated? Can the Department really afford to have experts in the large number of special sub-disciplines required to maintain a program of this type, i.e. can it afford to cover all the “-ologies” required? Can the number of group-specific courses be reduced by integration of concepts into fewer, but broader courses? Does the small size of the market for students educated in this program, and the resulting small number of majors, justify the cost to the Department? Societal and student demands for this area seem low—how does this reconcile with the Curriculum Priorities?)

The planned Center for Biodiversity and BA in Natural Science (concentration in Biodiversity Stewardship) seem to have some potential to help the faculty of this program generate resources for the College, but the impact on the Department is not defined. Nevertheless, the Department faculty members in all areas seem committed to the concept and willing to give it a chance to succeed.

**Recommendation:** Develop a plan that defends and reconciles the apparent interest in retaining this program with the evidence that shows decreases in both demand and resource generation. The plan should include how faculty in this group will generate resources required to keep the program afloat. These plans need to address real predicted enrollments numbers in all related programs.

**II.D. BS Marine Biology**

This is a very small program serving only 1% of the students. It is tied to the Moss Landing Marine Laboratory (MLML) program. The student demand has risen over the past five years and the cost to the Department seems low. Nevertheless, societal and students demands for this area seem low—how does this reconcile with the Curriculum Priorities? There is concern over the loss by retirement of faculty in this program, but no clear plan or assessment of the importance of the program to the Department is included. The special circumstances of MLML seem relevant but they are not addressed in a plan for the future.

**Recommendation:** Define how any department resources allocated to this program are justified. Argue why this program should not be transferred to CSU Monterey Bay, which is closer and seems to be the more efficient location for MLML students to reside academically.

**II.E. BS Microbiology**

This program serves 11% of the majors and is growing very rapidly. It appears to be very healthy and clearly serves a growing need as demonstrated by the growing enrollments. In the short-term, its association with the licensure in Clinical Laboratory Science as well as the practical application of this training insures the program’s future. Societal and student demands are high and growing. The faculty productivity in the area is strong. Nevertheless, the summary of future needs did not include an analysis of resources available to accomplish these needs.

**Recommendation:** Retain this program, but develop a long-term analysis for the CLS program and its association with the BS in microbiology.

**II. F. BS Molecular Biology**

This program serves 23% of all majors. The program seems healthy with high student demand generated by student awareness of societal needs for professionals educated in this area. Specific proposals aimed at strengthening this program are
included. The creation of a bioinformatics course and several other actions indicate a long-term plan for this program. However, without any input from the Department, it was proposed that the Department should cover the cost of these changes and make $500 per student available to enhance research activities of these students. What is the impact of such an expenditure on the other departmental programs?

**Recommendation:** Retain the program. Develop a plan for supporting the equipment needs of this program. Associate any equipment purchases with the research activities of the faculty. Provide an overview of the impact to the Department of increased program costs.

**II. G. BS Systems Physiology**

This program serves 18% of all majors and has exhibited continual growth over the past five years. This report provided the best analysis and plan for the future of all degree programs; however, the source of revenues required to offset some of the needs was not discussed in detail. The Department clearly needs to support the goals of this productive group, but whether the group can persuade the Department to support its needs is unclear. Can the group apply for NSF funding to help with equipment upgrade problems? That possibility was not directly addressed.

**Recommendation:** Retain the program. Develop a plan for replacing equipment and maintaining it for the long-term.

**III. Evaluation of the Biology Graduate Curriculum and its Degree Programs.**

**III. A. Overview of Graduate Curriculum**

Overall, the graduate curriculum is sound, but there are concerns about the health of the MS degrees in Physiology and Organismal & Conservation Biology (O&CB). These concerns center on the lack of a comprehensive departmental plan to deal with the recent retirements in these two areas. The reports from both groups define this as a problem and propose that new hires are important, but each report discusses the issue in isolation. The report form Molecular Biology & Microbiology discusses the role of “bridge” faculty and the value they have had for that group, but the reciprocal discussion was not included in the Physiology or Organismal & Conservation Biology reports.

The management of department resources for the five graduate degree programs needs to be addressed in a broad context and difficult decisions about the destiny of each program need to be made. O&CB and Physiology groups consider new hires to be necessary. M&M considers equipment purchases and service contracts to be the primary challenge. As discussed in section **V. Departmental Issues to Consider,** this reviewer considers the definition of RTP requirements, impact of faculty time, apparent limit to numbers of MS students per faculty lab, and level of support of faculty-student collaborative research as having a significant impact on the graduate program.

**III.B. MA Biological Science (Molecular Biology & Microbiology; Anatomy & Physiology; Clinical Laboratory Science)**

Students in this program align themselves with one of the areas to offer MS degrees but take 20% more course work and do not complete a master’s thesis. The enrollment in this degree seems to have leveled off over the past two years, but remains
healthy. Overall, this program meets student and societal needs and competes well with alternative opportunities in the region.

The Molecular Biology & Microbiology (M&M; 34% of MA students in Fall 2005) and Anatomy & Physiology (A&P; 11% of MA students in Fall 2005) groups have lost some students to Clinical Laboratory Sciences (CLS; 55% of MA students in Fall 2005) in the last two years, so the introduction of the latter MA seems only to have diverted students from the former two areas rather than attracting a new population of MS students. The Organismal & Evolutionary Biology (O&E; 0% of MA students in Fall 2005) group does not encourage their students to pursue the MA based on the contention that those practicing their sub-discipline as professions require a research experience.

The CLS meets a very practical need and is strongly supported by local hospitals. The program is generating students who exceed the national average on the certification exams and who are securing good jobs. The unanswered question is, “What will happen to the program and the faculty positions dedicated to it when the external support is lost?” Because the program educates 50% of the MA students, the report argues that the Department will want to fold the CLS MA program into its budget; however, there is no consideration of the fact that the program has not added new students to the Department MA program overall, simply diverted students who previously would have taken the MA in M&M or A&P. Thus, the continuation of the CLS program and the use of department resources to support it must address the ongoing need for students educated in that narrowly applied sub-discipline as opposed to the broader, more widely applicable M&M or A&P.

Recommendation: Retain the program. Evaluate the impact of folding in the CLS program. Create a mechanism to use MA students as TAs (if the role of TAs is expanded as suggested below). This may require developing a more rapid TA training program and perhaps requiring TAships of all MA graduate students.

III.C. MS in Biological Science (Molecular Biology & Microbiology; Physiology; Organismal & Conservation Biology)

These programs require a thesis, which seems to be research-based, but is not always completed in the lab of the major professor. The faculty members in the different areas are productive (as evidenced by grants and publications) to varying degrees. In the absence of a common departmental report (and an RTP document that clearly defines expectations), this disparity across groups and its acceptability is not clear. Also, the different groups tend to take on different numbers of graduate students before they call their labs “full”. How does this fit with the program objectives? How many graduate students are required in each program to support the necessary courses? O&CB states that students have often “come to the rescue” on some courses--what does that say about the strength of the program?

Based on the materials submitted in the PPR it appears that the O&CB and Physiology graduate programs need to be examined closely to determine how department resources should be allocated to rebuilding them. The Physiology program made stronger argument for rebuilding than the O&CB did. The latter may need to be reduced in size in light of the decreasing demand at both the BS and MS levels. Although the O&CB MS appears to be in greater demand than the O&E BS program, the two programs share faculty and therefore must be considered in a common analysis of resource allocation and departmental focus. During the review visitation, faculty members from
all areas of the department stated that they wanted to retain the O&E program, but if that is to occur, a focused plan for doing so needs to be presented. (The new program in Biodiversity & Stewardship and the new Center for Biodiversity were presented informally as solutions and may have positive effects, but a formal plan that includes them should be forthcoming).

**Recommendations:** Develop a focused plan for the role of O&CB and O&E program faculty in the UG and graduate programs. Address, in detail, how these faculty members can generate resources sufficient to sustain the programs in the manner deemed necessary and appropriate. (Conditions previously set by this group may need significant modification in order to balance revenue generation with resource consumption.)

**III.D. Masters in Biotechnology (MBT)**

The MBT is a recently introduced professional science masters that was created by cooperative activities of several department and non-department members. This is an innovative program that aims to prepare students for jobs in the regional and state biotechnology industry. It serves as a model for similar programs throughout the CSU. The curriculum is solid and draws on M&M faculty for much of its instruction. The program is meeting a societal and student need and appears to be placing students in solid productive positions. At the same time, as a program offers through university extension, it provides significant revenues to the Department.

However, at the time of the review, the program was in transition. The intent to draw the program into the Department and to convert the director to a tenure-track faculty member had failed to secure the services of the originating director. From the information that could be gathered anecdotally, it appears that there were problems of politics and communication. A program that had functioned effectively outside but closely tied to the Department seemed in danger of destruction through an awkward, poorly managed hiring process. There was not information and no plan offered for how the program would be assimilated and how the new director could achieve both the managerial responsibilities of the program and the teaching/research responsibilities required for tenure. The success of the program operating from outside the Department seemed to require that any change offer even stronger possibilities of success, however the situation at the time of the interview did not appear to offer that likelihood. The Dean should review the situation and seek to maintain the strength of an effective program and insure that a new director can meet all expectations of her/his position whether in or out of the Department—conflicting foci for the director could kill an excellent program.

**Recommendation:** Retain this program. Develop a plan that allows the director to succeed in running the program while meeting department expectations for RTP. Re-examine the wisdom of moving the director into the Department as an untenured faculty member under the conditions required for success of the program.

**IV. Assessment Program**

A comprehensive assessment program intended to evaluate knowledge and skills was outlined. Student learning goals have been set for each degree program and specific courses identified where data will be collected at the beginning and end of the students' progress through the degree. Some data have been collected and indicate that there is value added in the specified program. Additionally, an elaborate measure of success in mathematics and its correlation with success in various biology courses was presented.
The plan to assess communication skills was complete as well. The primary criticism of the plan is that it is very comprehensive and will require considerable resources in faculty time and departmental expense to achieve. In addition, there is no element in the plan to close the loop and insure that the information collected will have a positive impact on changes to the curriculum.

Recommendation: Have an expert in assessment analyze the plan and advise on how to retain the excellent intent while making it less labor intensive—eliminate processes that will be prohibitively expensive in time or dollars. Retain or add components that will provide the feedback required to improve the curricula in each of the programs.

V. Departmental Issues to Consider

Aside from consideration of the degree programs and their assessment, there are several areas in the Department that bear consideration.

V.A. Overall Department Plan

The PPR did not include a comprehensive plan that provided an overview of the Department and its plan for the future. Instead, the individual degree programs all presented its own report from its narrow perspective, each making a case for departmental resources in isolation of the other programs. The Department should have evaluated each report in the context of the whole Department and offered an analysis of where it wants to go. An analysis of departmental resources in the context of the allocation needs of each program would provide the University with an idea of whether new resources should be allocated to the Department as a whole. In this fashion, the Department takes responsibility for managing its internal affairs and deciding where emphasis for resource allocation will be directed in the coming five years and makes its case to the University.

During the review visit there was discussion among some faculty and evidence from recent hires that the Department intends to place greater emphasis on research productivity. However, the was no discussion of this in the PPR and no formal presentation of such a plan in the hiring information, which seemed to focus on instructional needs and maintaining the status quo. Any interest in increasing the role of research in Department requires redistribution of resources. If the Department wishes to change the environment for research, then resources must be made reallocated. Assistant professors need more release time, more and better research space, more start up funding, and more clear RTP expectations.

V.B. Faculty

Overall, the faculty is engaged in the activities of the Department and the members are broadly committed to student learning. There are some members nearing retirement who have pulled away a bit and some who see themselves as primarily teachers rather than researchers. Some faculty members are more successful in earning grants and publishing papers than others. This is a typical spread for a biology department of this age.

Faculty retirements were listed as a threat in a few degree program reports, especially those where student enrollments were waning. While this is indeed a threat for some groups, it is an opportunity for the Department to balance its degree programs and
curricular emphasis with the areas most widely selected by the students. At present, there is no long-term plan for hiring faculty into the various degree programs or to build research groups. The Department seems to be replacing like with like and/or meeting specific instructional needs in the absence of analysis of a broader restructuring of the Department and the meeting of new needs and goals.

Faculty members, whether tenure-track, tenured or temporary, all share offices. This is the only biology department in the CSU where all faculty share offices. Full-time faculty have a much higher load of advising—interacting with students in a shared office and having confidential conversations is a awkward at best and invasive of privacy rights at worst. Both situations are undesirable and the University should support alternate arrangements.

**Recommendation:**
(1) Develop a comprehensive plan that considers long-term faculty turnover and where hiring will be focused on specific objectives. This plan should include justification for each hire based on student demand and revenue generation weighed against resource consumption.

(2) Strive to create private offices for full-time faculty.

**V.C. Increased Focus on Research**

Based on conversations with recent hires, it appears that the Department is increasing its desire for and expectation of research activities. However, this change was not presented in the PPR as an element of a new department direction. If this is to become a redirection of department focus, then it is imperative that a plan to meet the needs of the new hires and provide an environment in which a more strongly focused research program can grow and thrive be in place.

**Recommendation:** Create a plan that defines the level of research desired by the Department. Address the following issues in this plan.

(1) The environment for new hires and other untenured faculty must be redefined in the context of: (a) starting salary, (b) start-up funds, (c) research space, (d) RTP criteria for tenure and promotion to associate, and (e) teaching loads.

(2) The environment for associate professors must be carefully considered with respect to: (a) RTP criteria for promotion to professor, (b) teaching loads for associate professors actively engaged in research and grant writing, and (c) renovation of research space.

(3) The allocation of resources within existing department structure, including the: (a) use of part-time faculty, and (b) use of teaching associates.

(4) The allocation of resources to the Department from College and University.

**V.C.1. Environment to Support Research by New Hires and Untenured Faculty**

As of Fall, 2006, to compete with other comprehensive universities in the region, including other CSU campuses, SJSU must offer new hires in biology salaries in the $58,000- $63,000. This is the range that CSU campuses of comparable size and research agenda are offering—with the housing costs in the Bay Area, offers at the high end, which will still fall short of allowing newcomers to establish themselves in the current housing market, will at least attract the attention of potential candidates.

According the Fall 2005 BioCouncil CSU Biology Department statistics (excerpted in Table 1) in biology departments across CSU where research is being
emphasized as an equal partner to teaching for scholarship, start-up funding is in the range of $75,000-$130,000, with the closest SJSU CSU competitor, San Francisco State, offering $125,000. Even the smaller East Bay campus reported $60,000 plus use of large equipment funding to purchase items to be shared between research and teaching activities. SJSU (most recent data from F2004) reported $55,000 as most recent start-up; that faculty member reported during the interview that this amount included $30,000 for specialized equipment and $25,000 to be paid over five years (that is only $5,000 per year—useful for materials, but no other major purchases). Nearly all other campuses pay their startup in the year the faculty member starts and allow it to be used over a two-year period. This encourages the faculty member to get her/his research lab operating rapidly and prepare grant applications early in the probationary period.

New SJSU hires were promised labs, but renovations are still not complete one or more years after hiring. If the Department’s expectations are for the faculty member to perform significant levels of research that result in successful extramural grant applications and peer reviewed publications, it must accept the responsibility of providing the basic research space adequate to perform the experiments required for such success. If special, high-cost enhancements are required, then the conditions for their acquisition by the faculty member should be part of the initial negotiations and the Department should be willing to modify expectations accordingly. To prevent ambiguity, written communications of specific agreements is advisable.

Research space for associate professors is highly variable in quality and, on average according to BioCouncil data (Table 1), is about half the space available for peers at campuses of comparable size. Most notably, a majority of the space is poorly arranged and, in the worst cases, may pose safety hazards for those who use them. Associate professors, although not entirely clear about the level of activity, feel strongly that research productivity is essential to their successful promotion. Yet, their labs are not all designed to achieve the RTP expectations.

It appears that start-up packages and other hiring conditions have not been openly discussed among the faculty members, at least not the assistant or associate professors. An environment of open communication among faculty members about issues relevant to the operation of the Department is advisable. The issues of salaries and start-up requirements need to be agreed upon by the group, and as new hires require more valuable packages, established faculty need to be aware of the underlying circumstances that dictate such increases.

Teaching loads reported by SJSU are higher than for campuses where research is a major focus. Generally, the 9-unit load translates into three courses rather than two and the addition of wtu's from labs means more hours dedicated to teaching than on campuses where TA carry the primary lab teaching responsibility. The load of new hires is one to two courses as opposed to one course on the other comparable campuses; however, like other campuses, the lighter load (relative to SJSU standards) is guaranteed for four semesters. Using more TA and part-time faculty (PTF) for appropriate labs and courses, respectively, could provide resources that would allow tenured and tenure-track faculty members greater time for research (see V.C.3. below).

**Recommendations:**

1. Define hiring criteria in writing at the end of negotiations.
2. Offer starting salary around $60,000
(3) Offer start up package valued at $60-75,000.
(4) Insure that acceptable lab space is available prior to the arrival of new faculty.
(5) Modify existing research space for associate professors.
(6) Offer reduced teaching loads to assistant and associate professors that allow
for the level of research expected.
(7) Open dialogue in the Department about hiring costs and offers to be made.

V.C.2. Defining RTP Criteria

Assistant and associate professors nearing their tenure and/or promotion decisions are uncertain of the specific criteria they must meet. As you might predict, associate professors have a better idea than assistant professors of the expectations, but an unnecessary level of anxiety exists in both groups. Assistant professors report that research expectations have risen in recent years, but no specific number of publications or level of grant success is stated in the RTP documents. The preparation of portfolios is not directed by specific departmental guidelines but rather by personal experience. It is the opinion of this reviewer that the RTP process should not be dependent on folklore, but should be spelled out clearly and provided to faculty at the beginning of their careers. Interestingly, during the PPR review interviews, it was clear that professors know that the RTP criteria are ambiguous—they prefer it to be so and feel that gives them greater flexibility in shaping targets to fit individuals. Perhaps from the top down this looks like a favorable method, but it is clearly unsettling to the assistant and associate professors to be faced with unspecified expectations. Defining criteria can still allow for flexibility and for selection for a diversity of skills among tenured faculty. It is the opinion of the reviewer that RTP process as it now stands is analogous to asking students to work as hard as they can and assuring them that their grades will be determined equitably but according to a scale and by a process that is not shared with them.

In addition, if higher levels of review do not agree with the Department decision, but the Department has not published and obtained approval of the criteria they are applying, how can the Department expect to prevail in a debate over either the granting or denial of tenure and/or promotion? In borderline cases, the absence of clear criteria results in the passing of responsibility for the final decision to higher levels; the Department maintains control over RTP decisions by defining criteria clearly and doing evaluations conscientiously. The department should make the definitive decision and that requires a strong set of guidelines that are acceptable to both the Department and University.

Recommendation:

1. Obtain RTP documents from biology departments throughout the CSU.
2. In consultation with the entire faculty, develop an RTP document that clearly identifies at least the threshold expectations for tenure and promotion.
3. Improve the mentoring system by identifying specific RTP-related tasks upon which mentor-mentee relationships can focus.

V.C.3. Providing Resources

Presently the Department has an Operating Budget similar to or larger than those of other campuses of similar size. As with all CSU Biology Departments, the operating budget is grossly inadequate to meet the operating costs. Without additional resources, a
department as diverse as biology cannot operate effectively. Departments on some other campuses have greater autonomy in using resources in making decisions with respect to long-term goals of the Department, and they retain a greater percentage of resources generated by the Department, including, in many cases, salary savings. Greater allocation of resources to the Department improves its ability to manage itself and eliminates the need for constant solicitation of resources, so the University should consider a mechanism whereby the Department can become more financially independent and therefore able to manage its own destiny more responsibly. In addition, there are two actions the Department can take to create more time (i.e., generate release time) for faculty to do research: (1) greater use of part-time faculty (PTF) and (2) greater use of graduate teaching associates (TA).

At present, the use of PTF and TA is 2-4 and 2-5 times, respectively, smaller than campuses of comparable size (Table 1). And, consistent with those ratios, data show that TAs generate 2-5 times more wtu on other campuses than at SJSU. The faculty argued during the PPR review discussions that they can provide better courses and labs than can the TAs, and this is, no doubt, true. But does the cost justify this expensive use of faculty time especially if the goals of increasing research productivity also contribute value to the Department and its students?

Unfortunately, even if it decides to increase use of PTF and TAs, the Department faces another serious problem with respect to hiring these individuals—the replacement cost per wtu allocated to the Department does not cover the full cost of the PTF or TA. PTF who have some experience in the Department cost around $4200 for a 3-unit course and the College transfers in $3450. This means that the Department loses money for every PTF hired. If the University is to support the Department’s efforts to increase research productivity—a process that will bring more resources (see Table 1) and accolade to the University in the long term—then it must assume responsibility for to support the Department in the endeavor. Under any circumstance, it seems inappropriate for the University to reimburse only part of the cost of PTF.

Increased attempts to seek external funding for equipment required for teaching and research was often mentioned in the PPR, but no specific sources were identified and no plan was proposed. The faculty members have a finite amount of time available for grant writing activities. A plan should be in place to organize this effort throughout the Department.

**Recommendations:**

**Department.**

1. Analyze the value of using more TA and PTF to generate wtu in the Department.
2. Identify courses and labs appropriate for these personnel to contribute to the goals of the Department.
3. Create a plan for annual submission of proposals to external programs in support of the needs of the Department.

**University.**

1. Re-examine allocation of replacement costs for PTF/TA and develop a mechanism whereby the real cost to the Department is covered.

**V.D. Staff**

The staff are highly qualified and strong, committed contributors to the Department. They recognize that they are appreciated, but they are not always well
informed. For example, they did not know about the PPR process and were not consulted about the planning. This limits their understanding of activities in the Department and limits their ability to contribute spontaneously.

The staff was not fully aware of budgets and found problems with the use of their P-cards. In some cases limitations seemed to be inappropriate and not in sync with activities at other campuses; e.g. computer tech needs to be able to spend on computing equipment without approval especially not that many items are under the limit for "equipment" purchases. Staff needs to be able to get infrastructure changes made more easily and need to have more direct access to service and repair personnel. Problems in University’s procedure for infrastructural changes need to be corrected. P-cards limits seem fine; ITC should not require prior approval for all purchases; restrictions on low-cost computing equipment is non-functional

**Recommendation:** Improve communications with staff and include them in departmental decision-making. Keep them fully informed.
TABLE 1: Data from Fall 2005 CSU BioCouncil Database. This is a comparison of CSU campuses of comparable size from throughout the state (Fullerton, Los Angeles, Pomona, and San Diego) and those from northern California that could compete for students (East Bay, Fresno, San Luis Obispo, Sacramento, and San Francisco).

<table>
<thead>
<tr>
<th>Criteria \ Campus</th>
<th>East Bay</th>
<th>Fresno</th>
<th>Fullerton</th>
<th>Long Beach</th>
<th>Los Angeles</th>
<th>Pomona</th>
<th>SLO</th>
<th>Sacramento</th>
<th>San Diego</th>
<th>SF State</th>
<th>San Jose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Campus enrollment (total)</td>
<td>13,061</td>
<td>20,371</td>
<td>35,040</td>
<td>35,000</td>
<td>20,307</td>
<td>19,885</td>
<td>18,475</td>
<td>27,932</td>
<td>31,802</td>
<td>28,804</td>
<td>29,044</td>
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<tr>
<td>2. Campus FTES</td>
<td>10,622</td>
<td>17,719</td>
<td>25,975</td>
<td>27,058</td>
<td>15,238</td>
<td>16,717</td>
<td>17,286</td>
<td>22,241</td>
<td>26,948</td>
<td>22,186</td>
<td>21,544</td>
</tr>
<tr>
<td>3. Biology enrollment FTES</td>
<td>400</td>
<td>620</td>
<td>886</td>
<td>908</td>
<td>431</td>
<td>821</td>
<td>722</td>
<td>686</td>
<td>1115</td>
<td>1047</td>
<td>697</td>
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<td>4. Biology UG majors</td>
<td>395</td>
<td>602</td>
<td>760</td>
<td>1440</td>
<td>548</td>
<td>1026</td>
<td>743</td>
<td>881</td>
<td>1179</td>
<td>1097</td>
<td>690</td>
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<td>5. Biology grad students</td>
<td>52</td>
<td>65</td>
<td>69</td>
<td>51</td>
<td>87</td>
<td>77</td>
<td>18</td>
<td>96</td>
<td>173</td>
<td>222</td>
<td>115</td>
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<tr>
<td>6. Total FTTEF for dept</td>
<td>16</td>
<td>22.7</td>
<td>41.67</td>
<td>nr</td>
<td>18.3</td>
<td>30.3</td>
<td>37.25</td>
<td>nr</td>
<td>39.7</td>
<td>49</td>
<td>30.5</td>
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<tr>
<td>7. SFR</td>
<td>24.9</td>
<td>27.3</td>
<td>19.6</td>
<td>nr</td>
<td>23.6</td>
<td>21</td>
<td>19.4</td>
<td>20.6</td>
<td>28.3</td>
<td>21</td>
<td>20.76</td>
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<tr>
<td>8. Tenure-track faculty (TTF)</td>
<td>13</td>
<td>14.5</td>
<td>23</td>
<td>29</td>
<td>19</td>
<td>32</td>
<td>26</td>
<td>26</td>
<td>37.3</td>
<td>46</td>
<td>25.8</td>
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<td>9. FTEF part-time lecturers</td>
<td>9</td>
<td>5</td>
<td>11.8</td>
<td>13</td>
<td>6.9</td>
<td>4</td>
<td>8.6</td>
<td>31</td>
<td>1.4</td>
<td>23</td>
<td>5.5</td>
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<tr>
<td>10. Graduate T.A.s (#)</td>
<td>7</td>
<td>25</td>
<td>37</td>
<td>24</td>
<td>12 to 19</td>
<td>38</td>
<td>23</td>
<td>8</td>
<td>100</td>
<td>23</td>
<td>12</td>
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<td>11. TA-generated wtu's</td>
<td>nr</td>
<td>73.2</td>
<td>198</td>
<td>nr</td>
<td>62-102</td>
<td>186</td>
<td>75.2</td>
<td>24</td>
<td>221</td>
<td>26</td>
<td>50</td>
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<tr>
<td>12. Release Time from grants (wtu)</td>
<td>90</td>
<td>44</td>
<td>63</td>
<td>nr</td>
<td>46.5</td>
<td>160</td>
<td>22</td>
<td>23</td>
<td>nr</td>
<td>132</td>
<td>30</td>
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<tr>
<td>13. Operating Budget (annual)</td>
<td>$73K</td>
<td>$124.8K</td>
<td>$97.6K</td>
<td>$40K</td>
<td>$85K</td>
<td>$95K</td>
<td>$185K</td>
<td>$119.3K</td>
<td>$92K</td>
<td>$152.6K</td>
<td>$122K</td>
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<td>14. Other funds received (annual)</td>
<td>$1.2K</td>
<td>nr</td>
<td>$23K</td>
<td>$40K</td>
<td>None</td>
<td>$7.5K</td>
<td>$410K</td>
<td>$14K</td>
<td>$140K</td>
<td>nr</td>
<td>$108K</td>
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<td>15. Equipment Budget (annual)</td>
<td>0</td>
<td>nr</td>
<td>$104K</td>
<td>0</td>
<td>$26K</td>
<td>$5K</td>
<td>(in OE &amp; CBF)</td>
<td>$29K</td>
<td>$190K</td>
<td>$150K</td>
<td>0</td>
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<tr>
<td>16. Overhead from grants (annual)</td>
<td>0</td>
<td>0</td>
<td>$170K</td>
<td>nr</td>
<td>$225K</td>
<td>$145K</td>
<td>$3,600</td>
<td>0</td>
<td>$121K</td>
<td>$1.5K</td>
<td></td>
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<tr>
<td>17. Avg faculty load (wtu)</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>nr</td>
<td>7</td>
<td>9</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>9</td>
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<td></td>
</tr>
<tr>
<td>18. Avg faculty release (wtu)</td>
<td>3.6</td>
<td>6</td>
<td>5</td>
<td>nr</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>19. Faculty w/ release time (%)</td>
<td>73%</td>
<td>88%</td>
<td>48%</td>
<td>nr</td>
<td>84%</td>
<td>76%</td>
<td>64%</td>
<td>76%</td>
<td>95%</td>
<td>69%</td>
<td>25%</td>
</tr>
<tr>
<td>20. Lab space-res active faculty (sf)</td>
<td>450</td>
<td>732</td>
<td>660</td>
<td>700</td>
<td>869</td>
<td>625</td>
<td>120</td>
<td>368</td>
<td>1000</td>
<td>1000</td>
<td>400</td>
</tr>
<tr>
<td>21. Funded grants-last three years (#)</td>
<td>nr</td>
<td>28</td>
<td>51</td>
<td>11</td>
<td>nr</td>
<td>35</td>
<td>45</td>
<td>35</td>
<td>242</td>
<td>many</td>
<td>5</td>
</tr>
<tr>
<td>22. Funded grants-last 3 years (total $)</td>
<td>$9M</td>
<td>$7.7M</td>
<td>$4.48M</td>
<td>nr</td>
<td>nr</td>
<td>$5.48M</td>
<td>$8.2M</td>
<td>$2.4M</td>
<td>$35.1M</td>
<td>$26.5M</td>
<td>$1M</td>
</tr>
<tr>
<td>23. TTF searches this year</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24. TTF hires last year</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>25. TTF Release, 1st year (wtu per session)</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>26. TTF Release, 2nd year (wtu per session)</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>as needed</td>
<td>6</td>
</tr>
<tr>
<td>27. Faculty offices (avg sf)</td>
<td>125</td>
<td>110</td>
<td>150</td>
<td>183</td>
<td>110</td>
<td>110</td>
<td>85</td>
<td>140</td>
<td>nr</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>28. TTF with shared offices (#)</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>nr</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>all</td>
<td>0</td>
<td>0</td>
<td>all</td>
</tr>
<tr>
<td>29. Part-time faculty with shared offices (#)</td>
<td>9</td>
<td>5</td>
<td>all</td>
<td>nr</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>all</td>
<td>13</td>
<td>22</td>
<td>all</td>
</tr>
<tr>
<td>30. Startup funds-most recent TTF</td>
<td>$60K</td>
<td>$100K</td>
<td>$85K</td>
<td>$130K</td>
<td>$80K</td>
<td>$20K</td>
<td>$25K</td>
<td>$120K</td>
<td>nr</td>
<td>$50K</td>
<td></td>
</tr>
<tr>
<td>31. Salary offered to most recent TTF</td>
<td>$52K</td>
<td>$51K</td>
<td>$60K</td>
<td>$63K</td>
<td>$60K</td>
<td>$59K</td>
<td>$63K</td>
<td>$48K</td>
<td>$65K</td>
<td>nr</td>
<td>$55K</td>
</tr>
</tbody>
</table>

* Most recent data available for SJSU is from Fall, 2004 database. nr = not reported
March 25, 2006

Dr. Robert A. Koch
California State University, Fullerton
Department of Biological Sciences
P.O. Box 6850
Fullerton, CA 92834-6850

Dear Dr. Koch:

Thank you for agreeing to serve as the external reviewer for San José State University's Program in Biological Sciences. Reviewers take on such a task only out of love for the profession and respect for their colleagues, definitely not as a way of building retirement income. SJSU will pay an honorarium of $1,000 in appreciation of your willingness to serve as a reviewer, and from that amount you are expected to cover your own expenses. Typically the host department provides at least some meals. The Chair of the program, Sally Veregge, will help you complete the necessary paperwork, and will see that you are paid promptly.

In accepting this assignment, you agree to review the self-study prepared by the program. Please feel free to ask Dr. Veregge or this office for any additional materials you need. Additionally, the university website has much information, especially on the College of Science in the Statistical Abstracts at http://www.ipar.jsu.edu/Data_&_Reporting/Statistical_Abstract.cfm.

The visit itself should take about a day and a half to two days. It typically begins with an administrative overview that includes me, the College Dean Vida Kenk, the Associate VP for Graduate Studies and Research Dr. Pamela Stacks and the Vice Provost for Planning and Budget Bill Nance. This will be a good opportunity for you to clarify with us the key university goals of your visit. You will then meet with faculty, staff, students, and graduates of the program. I encourage you to be forthright in your questioning and probing. Please let me know if, having seen the schedule for the visit, you would like to have any additions made to that schedule.

The visit ends with your presenting an exit interview of about 45 minutes. Some reviewers prefer to make a statement that is then open to questions; others prefer an interactive format throughout the interview. That choice is yours. The interview may be recorded for the use of faculty who are not able to attend. Your exit interview will be attended by several administrators, the College Dean, the liaison faculty member from the Program Planning Committee, the Director of Assessment and as many program faculty as are available. Reviewers normally do not have meetings with the Provost.
San José State's review process emphasizes planning rather than retrospective evaluation. The Dean and the Provost want to ensure that the program is making realistic plans for curricular development, for faculty hiring and for strategies to garner whatever additional resources might be necessary for the program's success. In the CSU, a program's intentions must match the probability that there will in fact continue to be students desirous of enrolling in the program, so it is important to take into account the SJSU student in evaluating the plans.

The Program Planning guidelines, which I enclose, require that the program have a definite plan for collecting evidence of student learning. As you are aware, regional and specialized accreditation agencies now insist that programs document their educational successes, and show how they are making program modifications based on data rather than anecdote. SJSU believes that assessment of student learning must be carried out by faculty, and that the program level is the most effective place for faculty to undertake this work. By spring 2006 all programs are expected to have collected and analyzed data on at least some student learning outcomes. Please address the program's strengths and weaknesses in systematic assessment of student learning in the exit interview and in your written report. Such assessment often takes different forms in graduate programs, yet such typically undergraduate "general education" issues as communication skills, teamwork, global and cultural sensitivity, environmental awareness, and the like, remain critical. Also, a program's encouragement for and success in research and scholarship is essential at the graduate level. In all events, the program's assessments should be closely matched to its specific goals.

We will expect a written report within three weeks of your visit. Please send that report to me. The written report, and any comments the program cares to make, will then provide the basis for recommendations to the Provost by a College committee, the College Dean, and the Program Planning committee.

Again, thank you for your assistance in this process, and I encourage you to call or email me (rocoop@email.sjsu.edu) should you have questions or should you like to engage in any preliminary discussion about your visit. I look forward to meeting you, and I thank you for your assistance in this important planning task. Dr. Verregge will contact you directly about scheduling the date of the visit.

Sincerely,

Robert Cooper, Ph.D
Associate Vice President

Attachments

C: Sally Verregge, Chair, Biological Sciences
   Vida Kenk, Interim Dean, College of Science
   Pamela Stacks, AVP, Graduate Studies & Research
   Dan Perales, Chair, Program Planning Committee
   Ken Wharton, Co-Chair, Program Planning Committee
Date: March 21, 2006

To: Bob Cooper  
AVP Undergraduate Studies

From: Vida C. Kenk  
Interim Dean, College of Science

Re: Appointment of external reviewer for program review of  
Biological Sciences Department

The Department of Biological Sciences has nominated three distinguished individuals to serve as external reviewers. All of them are well qualified, as you can see from their attached curriculum vitae (should the plural be curricula vitarum?). I would especially recommend to you Professor Robert Koch, who serves in a Biological Science Department that is in many ways comparable to ours and who has considerable experience in the areas in which our department is growing.

C. Sally Verege, Chair of Biological Science

Dr. Robert Koch
3/22/06
ROBERT A. KOCH
(October, 2005)

UNIVERSITY ADDRESS
Department of Biological Science, California State University, Fullerton, P.O. Box 6850, Fullerton, CA 92834-6850 USA, tel:714-278-3637, fax:714-278-3426, rkoch@fullerton.edu

EDUCATION
Ph.D., Biological Science (Physiology, Mentor: Dr. Michael J. Greenberg), Florida State University, Tallahassee, FL, 1976.
M.S., Biological Science (Physiology, Mentor: Dr. Michael J. Greenberg), Florida State University, Tallahassee, FL, 1971.
B.S., Biology-Chemistry (Interdivisional), Eckerd College, St. Petersburg, Florida, 1969.

RESEARCH AND TEACHING EXPERIENCE
Visiting Scientist, Department of Developmental Biology and Genetics, Caltech (1999).
Organizer, Center for Applied Biotechnology Studies/Program for Applied Biotechnology Studies (2001-present)
Department of Biological Science, California State University, Fullerton,
Director, Center for Applied Biotechnology Studies (2003-present)
Director, MARC Program (1999 - 2004),
Director, Beckman Coulter Graduate Research Scholars Program (1999 - 2003),
Director, Beckman Program (1999 - 2001),
Director, Microscopy Facilities (1984 - present),
Director, Institute of Molecular Biology and Nutrition (1989 - 1995)
Chair (2004-present)
Vice Chair (2003 - 2004)
Professor (1985 - present),
Associate Professor (1980 - 1985),
Assistant Professor (1976 - 1980).
Teaching (since 1992): Lower-division core for majors — Cellular Basis of Life (Sp03, F03, Sp04, F04); Upper-division core for majors — Cell and Developmental Biology (F93, Sm95, Sp96, Sp97, Sp98, F98, Sp99, Sp01, F01, Sp02); Advanced courses for majors and graduate students — Mammalian Physiology (F94, Sp95), Introductory Electron Microscopy (F92, F94), Advances in Cell Biology (F95, F96, F97, F97, F99, F00, F02), Advanced Topics in Transmission and Scanning Electron Microscopy (AY 92-99), MARC Proseminar (F96-present), and Independent Laboratory Research (F92-present); Introductory level for non-majors — Elements of Biology (Sp 92, Sp93, Sp94, F95); Upper-division for non-majors — Biology of Aging (Sp92, Sp93, Sp94, Sp95).
Research: Studies on cell signaling, cytoskeletal reorganization, and cell adhesion in ascidian sperm-egg interactions and sperm activation; Ultrastructure of ascidian sperm and eggs.

PROFESSIONAL AFFILIATIONS
American Association for the Advancement of Science (1976-present; Council, Biological Science Delegate-1999-01); American Society for Cell Biology (1985-present; Congressional Liaison Committee, 1992-present); California State University Program for Education and Research in Biotechnology (1986, Board of Governors, 1992-present; Symposium Organizer, 1993-present; Executive Committee, 1996-00; Strategic Planning Council, Chair, 2000-present); California State University, Fullerton Center for Applied Biotechnology Studies (CABS) (2001-present, Organizer), California State University, Fullerton Institute for Molecular Biology and Nutrition (1976-present, Director, 1989-95); California State University Microscopy Colloquium (1976-present, President, 1985); Microscopy Society of America (1982-present; Chair, Local Organizing Committee, 2001 Annual Meeting); Society for the Advancement of Chicanos and Native American Scientists (1996-present); Southern California Society for Microscopy and Microanalysis (1978-present; Vice President-Biology, 1993-95, 98-00; President, 1995-96, 00-01; Chair, Local Organizing Committee 2001 MSA Annual Meeting, 1993-01).
AWARDS
NSF Undergraduate Summer Research Fellow (1968), NIH Graduate Research Assistantship (1969-71; 73-76), CSUF Competitive Sabbatical Research Leave (1984, 91), CSU Award for Research, Scholarship and Creative Activity (1989, 90), Meritorious Performance and Professional Promise Award (1989), School of Natural Science and Mathematics Dean's Award (1989), Student Health Professions Association Professor-of-the-Year Award (1989), Biology Faculty Distinguished Service Award (1994), CSUF Teacher-Scholar Recognition (1996), SNMS Distinguished Faculty Member Award (1996), CSUF Outstanding Faculty Service Recognition (1997), SNMS Faculty Marshal (Commencement, 1997), Outstanding University Faculty Scholarship and Creative Activities Recognition (1998), CSUPERB Faculty Research Award (2000); CSUF Outstanding Faculty Recognition: Scholarly & Creative Activity (2001); CSUF Outstanding Faculty Recognition: Enhancing Student Learning (2002); CSUF Outstanding Faculty Recognition: Contributing to Student Success (2002); CSUF Outstanding Faculty Recognition: Service to University (2003).

GRANTS (since 1992, active grants in bold)
**Intramural**, Biology Department Faculty Research Grant (variable amounts; 92-present), CSUF Faculty Research Grant ($3,500 each; 95, 96, 01/02), Undergraduate Student Research Initiative Awards ($1,000 each; 96/w-Goel, Lauzon, Whalen; 97-w/Rabadi, Jacobson; 98-w/Lotfizadeh, Ghabadi and Jahangiri; 01-02 w/Mohammad Hanizavareh); 03-04 w/Ladrón de Guava.

SERVICE ACTIVITIES

Department (since 1995):
Core Curriculum Revision Committee (97/98-03); Cell Teaching Collaborative (Chair, 97/98-04); Cell and Developmental Biology Concentration Team (00/01-04); Long-range Planning Committee (94/95, Chair, 95/96-present); Personnel Committee (Chair 92/93-94/95, Member 96/97-97/98, 01-03); Search Committees (93/94, Chair 96/97, 97/98, 99/00, 00/01, 01/02, 03/04); Vice Chair (7/2003-8/04).

College (since 1995):
Biotechnology Steering Committee (Chair, 90/91-96); Director, Electron Microscope Facility (84/85-present); Radiation Safety Committee (78/79-98/99, Chair 95-96); SNSM Faculty Awards Committee (Chair, 96/97); CNSM Dean’s Advisory Board (2004-present); Center for Applied Biotechnology Studies (CABS, approved 30 July, 2003, Founding Director, 2001-present); Program for Applied Biotechnology Studies (PABS, Organizer, 2003-present).

University (since 1995):
Ad hoc Academic Calendar Committee (Sp97, F97); Research Committee (91/92-93/94, 97/98); Gerontology Program Council (86-present); Institutional Animal Care and Use Committee (85/86-97/98); MBRs/Minority Access to Research Careers (MARC) Advisory Board (89-93, 96-97); MBRs Advisory Board (89-93, 96-97); MSD/MARC Student Selections Subcommittee (98-present); MBRs Student Selections Subcommittee (89-93, 96-present); MBRs Investigator (93-97); MSD Investigator (98-present); MARC Director/Mentor (96-present); Chief Information Technology Officer Search Committee (2005); University Information Technology Committee (2005-present).

CSU System (since 1995):
BioCouncil (2003-present; Sec-Treas 2004-present); California State University Program for Education and Research in Biotechnology (CSUPERB), Board of Governors/Faculty Consensus Group (1992-present), Symposium Organizer (1993-2000), Executive Committee (1996-99), Strategic Planning Council (Chair, 1999-present), Student Travel Committee, Chair (1997-00); California State University Microscopy Colloquium (1976-present, Board Member 1976-present, poster judge, 19996, 1999).

Community (since 1995):
Guest Speaker on Cell Biology & Electron Microscopy (local intermediate and high schools, on-going); Steering Committee Member, Anaheim Terrace Residence Coalition (on-going); Conduct tours of CSUF Electron Microscopy Facility (for local high schools, on-going); Advisor to high school student researchers (e.g., NSF Young Scholars, So. Cal. Jr. Acad. Science, and Troy Tech, on-going); Scientist Member, Westminster School District Beckman@Science Initiative Strategic Planning Committee (98-01); Conference Staff, Beckman@Science Orange County LASER Regional Partnership at Cal State Fullerton (98, 99).

Professional (other than discipline-based organizations, since 1999):
Beckman@Science/LASER Institute, Beckman Center, Apr. 1999, Resource Team Member West Coast Biological Science Undergraduate Research Conference, Beckman Center, UCI, May, 1999 Chair, Cell Biology Session.

PAPERS AND PUBLISHED ABSTRACTS (since 1997; plus a pre-1997 total of 33; * denotes UG and # Grad student authors)


IN PREPARATION

Kim, J. and R.A. Koch. PLCβ activity triggers internal Ca release and PKC activity in ascidian sperm activation. 60% prepared for *Dev. Biol.*

PRESENTATIONS (since 1997; plus a pre-1995 total of 51)


61. Koch, R.A. "Boy meets girl and then what? Cell signaling and actin/myosin interactions in ascidian sperm activation." Biology Department Seminar, Sonoma State University, Rohnert Park, CA (Nov. 2001)


PRESENTATIONS BY STUDENTS (since 1997, plus a pre-1997 total of 52. Student authors are underlined, presenter is marked with asterisk.)


81. Mehta, P.*, T. Nguyen*, T. Waters, and R.A. Koch “Blockage of Ascidian ceratodes sperm activation as characterized by mitochondrial translocation (MTL) by wortmannin as a result of selective Inhibition of phosphatidylinositol 3-kinase” West Coast Biological Science Undergraduate Research Conference, UC Irvine (May 1999).
101. McNulty, R.* “Signaling in ascidian sperm activation requires a change in membrane potential.” CSUPERB Biotechnology Symposium, Pomona, CA (Jan 2002).

**SPECIAL HONORS TO UNDERGRADUATE RESEARCHERS**

Francine Garrett: Member, Minority Biomedical Research Support (MBRS) Program (94-96); American Chemical Society Undergraduate Fellowship (95-96); ACS General Chemistry Prize (93); ACS Organic Chemistry Prize (94); ACS Physical Chemistry Prize (95); First place, CSUF Research Competition (95, 96); Honorable Mention, CSU Research Competition (96); CSUF Presentation Prize (96); Alumni Outstanding Graduate Award (96); Miles D. McCarthy Scholarship (96); Acceptance into Yeshiva University Albert Einstein Medical College Medical Scientist Training Program (MSTP, 96); NCI Predoctoral Fellowship (97-00); UNCF-Merck Graduate Science Research Dissertation Fellowship (01-04); National Chair, Student National Medical Association (01-02).

Phuongan (An) Dam: Member, MBRS Program (95/96), Outstanding Experimental Chemistry Award (96); Howard Hughes Predoctoral Fellowship at University of Wisconsin-Madison (97-00); graduated with PhD (Aug 02).

Haimanot Girma (96-98), Nancy Hurtado (99/00), Karen Martinez (98/99), Mayvee Witherspoon (96-98), Emily Zebadua (98/99-00/01), Lamar Blackwell (00/01): Member, MSD.

Linda Lauzon: CSUF Research and Creative Activity Award (96/97); CSUF Departmental Associations Council Research Grant (98); acceptance into medical school at Medical College of Wisconsin (98); graduation (June 02).

Sean Whalen (96/97). CSUF Research and Creative Activity Award, HHI Medical Research Fellowship (UCI Med Sch, 99-01), graduation (June 02).

Nicole Jacobson (97/98), Alissar Rabadi (97/98), Ali Lotfi-zadeh, Ali Ghobadi, Pamela Ishangiri (98/99), Mohammad Hanizavareh (00/01): CSUF Research and Creative Activity Award.

Nancy Hurtado: MARC Scholar (96/97-98/99); Dean’s List (94-99); Jewel Plummer Cobb Scholarship (94-95); Gold Key Honor Society (94-present); MIRT scholar (summer 99); MSD member (99/00); first year of PhD at University of Iowa; candidate for PhD at UCSD.

Nikki Pinkerton: MARC Scholar (96/97, 97/98); Dean’s List (94-98); Gold Key Honor Society; Caltech Summer UG Researcher (97); Biology Service Award (96/97); Graduation with Highest Honors (June, 1998); American Society for Quality Control Award for Outstanding Minority Biomedical Research (MARC) (June, 98); Miles D. McCarthy Health Professions Award (June, 98); President’s Associates Service Award (June, 98); Commencement Speaker (June, 98); Acceptance in Yale University MSTP (98); Graduation from Yale School of Medicine (June 02).

Ali Lotfi-zadeh: First Place, CSU Systemwide Student Research Competition (May, 98); Beckman Coulter Fellow (98/99); Beckman Scholar (99/00-00/01); Miles D. McCarthy Health Professions Award (June, 01); acceptance into University of California, Los Angeles MSTP (03).

Ali Ghobadi: Beckman Coulter Fellow (99/00); acceptance into medical school UCSD (May, 01).
9 May 2007

To: J. Michael Parrish, Dean, College of Science
From: Stephen Branz, Acting Associate Dean, College of Science
Cc: Program Planning Committee (c/o Undergraduate Studies)
    John Boothby, Chair, Department of Biological Sciences
    Sally Veregge, Past-Chair, Department of Biological Sciences
Re: Biological Sciences Program Planning (2005-2006 cycle)

The College of Science (COS) Curriculum Committee reviewed (1) the Department of Biological Sciences Self Study (Fall 2005), (2) the External Reviewer Report (May 2006), and (3) the response from Dr. Veregge (February 20, 2007) on behalf of the Department of Biological Sciences and its faculty. Taken as a whole, we feel that the External Reviewer, Dr. Robert Koch (Chair, Biological Sciences, CSU Fullerton), has done a masterful job of getting to the essence of this very large and complex department. There are few if any departments at SJSU with a similarly diverse array of degree programs. Dr. Koch has articulated the strengths and weaknesses of the department very well. His evaluation is based on a strong knowledge of what is possible within the CSU system and he has provided an extensive data table comparing the Biological Sciences at SJSU with comparable departments throughout the state. Dr. Koch's recommendations in Section I.B. align with the November 2006 revised Program Planning Guidelines and we endorse them all. His recommendations were directed to both the department and the university, and we will expand on each set in turn.

Dr. Koch's recommendations -- Department:

(1) Increase communication among all department stakeholders (i.e., among faculty and between faculty and staff) and include faculty and staff in managerial decision-making.

(2) Develop a comprehensive three- or five-year plan that looks at the Department as a whole, including a revenue-generated-to-resource consumed comparison for the Department overall.

We recognize that collegiality is a hallmark of the department, but that is not the same thing as the sort of cost/benefit analysis and centralized resource analysis advocated by Dr. Koch. Clearly, significant individual and departmental efforts were put into generating the Self Study, but in many ways it does not read as a unified summary and plan for the future. Perhaps this is the consequence of the size and diversity of programs mentioned above, but the various divisions within the department seem to be analyzing their programs from different perspectives entirely. The Self Study lacks a common voice. A memo from Sally Veregge to the Program Planning Committee (December 7, 2005; attached to this memo) indicates that similar comments were made about the structure of the Self Study for the 2000-01 Program Planning cycle. Unfortunately these were received after the drafting of the current Self Study was well underway.
Our committee raised questions that are more rhetorical in nature, but speak to the fact that these perspectives were not fully addressed in the Self Study. Typical comments/questions: “Is Biology spread too thin?” “Where does the department want to go?” and “There should be more effort to obtain grant support for undergraduate research.” The structure of the Self Study encouraged local/divisional analysis, not global/departmental analysis about these and other issues. Section V of Dr. Koch’s external review (Departmental Issues to Consider) recapitulates a number of these points. He states clearly the need for an Overall Department Plan (Sect. V.A.) including a comprehensive plan for faculty recruitment (Sect. V.B.), and the Increased Focus on Research (Sect. V.C.).

We note that Dr. Koch definitely examined the department from an administrator’s point of view and this tends to shortchange the faculty perspective at times. We do recognize that the department has a deserved reputation for excellent pedagogy, assessment, and strong student-faculty interactions. Two specific items deserve special mention. The first is that Dr. Koch recommended that the BA, Preparation for Teaching “...should be discontinued...” As all courses required for this degree are common to other degree programs in the department, there are no resources consumed by this program and we disagree with this specific recommendation. The second item is that the BA, Natural Science was not included in the Self Study or the review and it should have been.

Dr. Veregge’s departmental response should be read carefully. She convincingly counters some of Dr. Koch’s conclusions. In particular, she describes the long-range planning involved in hiring “bridge” faculty whose interests and abilities are multidisciplinary, and the creation of new degree programs to attract resources and FTES. These initiatives represent global/departmental issues paid too little attention in the current Self Study.

Dr. Koch’s recommendations -- University:

1. More clearly define the mechanism by which departments can generate a PPR that allows the reviewer to evaluate a long-term plan—this may only require that the Future Plans section specify the conditions required for the plan to meet expectations.
2. Establish a mechanism to insure that a department-wide perspective is included in the PPR.
3. Require a cursory review of the PPR by the Dean to see that a departmental perspective and long-term plans are present such that an outside reviewer can reach the conclusions expected by the University.

Dr. Koch’s university level recommendations are addressed much more directly in the Fall 2006 Revised SJSU Program Planning Guidelines. For example, certain boilerplate data will be provided to a department beginning its Self Study. This will allow the department to focus more attention on analysis and planning. An Executive Summary is now required and the sections defined in the Guidelines are (1) Description of the Department and its Program(s), (2) Synopsis of the Previous Program Review Recommendations, and (3) Summary of the Present Program Review Recommendations. This explicitly includes subsections for Curricular, Student, Faculty, and Resource Recommendations. Dr. Koch’s third recommendation is also included in the new Guidelines. The Dean must do a preliminary review and certify that the “draft [Self-Study] has been read and deemed ready for external review.”