

**CALIFORNIA STATE UNIVERSITY, EAST BAY**

DESIGNATION CODE: **2007-08 CAPR 20**

DATE SUBMITTED: April 28, 2008

**TO:** The Academic Senate

**FROM:** The Committee on Academic Planning and Review (CAPR)

**SUBJECT:** Five-Year Program Review for Chemistry and Biochemistry

**PURPOSE:** For Action by the Academic Senate

**ACTION REQUESTED:** Acceptance of the Five-Year Program Review of Chemistry and Biochemistry and Approval of the Continuation of the Program without modification

**Executive Summary**

During the past five years The Department of Chemistry and Biochemistry has done an outstanding job in the areas of curriculum development, assessment, and student and faculty research. The number of majors enrolled in the department programs has grown by 45% in the last five years, while the FTES generated by the department has increased by 50%. The department has presented clear plans on accommodating this growth while continuing to maintain and improve their programs. The main recommendations of CAPR are that the department *i)* aggressively pursue more tenure track hires to keep pace with their growing enrollment, *ii)* work with the administration to find a mechanism for compensating their faculty for the rapidly escalating work load associated with mentoring students on research projects and *iii)* negotiate an additional half-time departmental office staff position.

**CAPR RECOMMENDATION FOR CONTINUATION OF THE PROGRAM**

CAPR recommends the continuation of the Chemistry and Biochemistry Programs without modification. The date of the next Five-Year Review is 2012-2013.

## **CAPR Report**

### **1. BACKGROUND**

#### **1.1 Overview description of program**

The Department of Chemistry and Biochemistry consists of 7 full time TT faculty and several part time lecturers. As of the fall of 2007 the department had 140 undergraduate, 9 post-baccalaureate, and 47 graduate students. In the fall of 2006 the department generated 245 FTES. The department has experienced a large growth in the number of undergraduate and graduate students enrolled in the program and the number of FTES generated in the last five years. Highlights of the program are given below.

- The department offers six undergraduate and two graduate degree programs: B.S. degree major in Chemistry; B.S. degree major in Biochemistry; B.S. degree major in Chemistry, option in Forensic Science; B.A. degree major in Chemistry; B.A. degree major in Biochemistry; Minor in Chemistry; M.S. in Chemistry; and M.S. Option in Biochemistry.
- In the M.S. Chemistry graduate program, students choose either Plan A which involves working with a faculty mentor on a research project and writing a thesis, or Plan B which requires a comprehensive exam and writing a comprehensive literature review paper under the guidance of a faculty member. Currently there is no Plan B for the Option in Biochemistry program.
- In addition to serving its majors, the department contributes significantly to the General Education (GE) curriculum and teaches service courses for the Nursing program and other programs within the College of Science.
- The department has a strong research culture. Faculty has published 18 papers in the last five years and has obtained extramural funding from several agencies including NIH, NSF, CALFED, and CICORE (NOAA-funded). During the past five years, approximately 85 undergraduates have participated in undergraduate research with a faculty advisor. Approximately 30 MS students conducted on-campus research with a faculty member. This research activity has led to 68 student presentations at national and local scientific meetings.

#### **1.2 Overview of the documents submitted to CAPR**

The report to CAPR included:

- A Self – Study
- A plan for the program for 2007 – 2011
- Report of the Outside Reviewer
- Program response to the outside Reviewer’s Report
- Student Learning Outcomes

### **2. FIVE-YEAR PROGRAM REVIEW/SELF-STUDY**

#### **2.1 Summary of Specific areas of the Self-Study**

##### *Program achievements*

- Replaced the BA Chemistry, Option in Biochemistry degree program with a new BA Biochemistry degree and modified the degree requirements.
- Developed a new intermediate level lecture/laboratory course that applies analytical techniques to forensic science (Chem 3200). A one quarter physical chemistry course (Chem 3501),

emphasizing principles used in biological science and biochemistry, was developed for the BA Chemistry and BA Biochemistry degrees.

- An NSF-Major Research Instrumentation Grant for \$435,523 was awarded for the purchase of a High-Field Multi-Nuclear FT-NMR spectrometer in 2005. This instrument is vital to the department for structure elucidation in research and has been used in several laboratory classes.
- The department has acquired several other instruments for research and teaching labs including a second high performance liquid chromatography (HPLC) apparatus with gradient capabilities, a fast protein liquid chromatography (FPLC) instrument, an optical microscope, a uv/vis spectrometer with a temperature controller, a fermenter, and a chromatotron radial chromatography instrument.
- Research activity during the past five years has increased dramatically. External grants have been awarded to faculty within the department by the NIH, NSF, CALFED, and CICORE (NOAA-funded). Faculty has also been successful at generating funding from the CSU Program for Education and Research Biotechnology (CSUPERB) and the CSUEB Faculty Support Grants (RSCA). Cumulatively, the Department of Chemistry and Biochemistry faculty published 18 papers in the last five years.
- During the past five years, approximately 85 undergraduates have participated in undergraduate research with a faculty advisor. Approximately 30 MS students conducted on-campus research with a faculty member. This research activity has led to 68 student presentations at national and local scientific meetings.
- During the past five years, student achievement has continued at a high level. Each year several students were admitted to Ph.D. programs or professional schools. Five students received Associated Student Fellowship or Scholarship awards for research projects (\$1,800 or \$1,200 awards). Two students received Schering-Plough research awards to fund laboratory projects. One undergraduate earned a \$5,000 Genentech Scholar's award and a Master's student received the 2006 Crellin Pauling award for excellence in teaching from CSUPERB. Additionally, at least two students were awarded local scholarships each year.

#### *Curriculum and Student Learning*

- The department has an outstanding assessment plan that was a model during the recent WASC accreditation process. The department has a comprehensive set of Learning Outcomes for the upper division courses in its Degrees Programs.
- Standardized testing at the end of undergraduates year long organic chemistry sequence demonstrates that the department's students learning is on par with the national average.
- Analysis of the assessment results in GE have indicated that an improvement in students' mastery of the concepts was observed when tutoring was offered for the class and more effort was put into integrating lecture concepts into the laboratory.
- The requirements of the program are similar to other CSU and UC campuses. The department awards about the same number of undergraduate and graduate degrees as SJSU, a campus that is nearly three times as large.

#### *Students, Advising, and Retention*

- The department has grown substantially during the last five years. In fall 2001, total FTES was 162, and in fall 2006, FTES had increased by 50% to 243.
- From fall 2002 to fall 2007, the number of majors rose from 135 to 196, a 45% increase.
- The department awarded a total of 26 degrees in 2001-02 and 46 in 2006-07, a 77% increase.
- The department SFR is near 20 for both TT faculty and lecturers and for both upper and lower division courses.
- The department has developed a set of new roadmaps for its programs to aid in student advising. It has also spread the role of advising undergraduate students to all full-time TT faculty.

Students are assigned an advisor when they enter the department and that advisor remains with them throughout their academic careers. The department also delegates advising responsibilities of both thesis and non-thesis MS students to all full-time TT faculty members.

### Faculty

- The department has had five new faculty members join the department since 2002. However due to retirements, separation, and the death of a faculty member, the number of faculty has remained at seven. The department is conducting two searches during the current academic year, and plans three more searches in the next two years.

### Requirements

- Two of the five baccalaureate degrees offered by the department require more than 180 units. These are the B.S. Chemistry with Option in Forensic Science degree and the B.S. Biochemistry program. Both degrees encompass additional disciplines beyond those traditionally required in chemistry programs, which results in the additional required units.

## 2.2 Summary of supporting data

<b>A. Students</b>	<b>Fall Quarter</b>						<b>2007</b>
	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	
1. Undergraduate	85	114	118	118	141	136	140
2. Graduate	16	21	28	37	36	45	56
3. Total Number of Majors	101	135	146	155	177	181	196
4. FTES Generated	161.6	175.6	194.6	225.7	229.0	245.3	

<b>B. Degrees Awarded</b>	<b>College Years</b>						
	<b>00-01</b>	<b>01-02</b>	<b>02-03</b>	<b>03-04</b>	<b>04-05</b>	<b>05-06</b>	<b>06-07</b>
1. Undergraduate	15	22	19	22	30	29	35
2. Graduate	7	4	3	4	5	4	11
3. Total	22	26	22	26	35	33	46

<b>C. Faculty</b>	<b>Fall Quarter</b>					
	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Tenured/Track Headcount</b>						
1. Full-Time	7	5	7	7	7	7
2. Part-Time	1	3	2	2	2	2
3. Total Tenure Track	8	8	9	9	9	9
<b>Lecturer Headcount</b>						
4. Full-Time	0	0	0	0	0	0
5. Part-Time	5	6	4	5	6	5
6. Total Non-Tenure Track	5	6	4	5	6	5

<b>D. Student Faculty Ratios</b>	<b>Fall Quarter</b>					
	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2005</b>	<b>2006</b>
1. Tenured/Track	16.4	20.4	21.3	19.4	17.0	21.2
2. Lecturer	20.0	22.5	18.1	23.1	21.3	17.5
3. SFR By Level (All Faculty)	17.8	21.2	20.5	20.7	18.6	20.1
4. Lower Division	24.4	23.7	24.8	22.7	22.7	23.9
5. Upper Division	19.8	17.8	18.9	16.7	16.7	19.1
6. Graduate	8.3	7.5	5.2	5.9	5.9	9.1

### 3. OUTSIDE REVIEWERS REPORT & THE DEPARTMENTS RESPONSE

#### 3.1 Outside Reviewer's Report

Dr. Jane DeWitt, Professor of Chemistry and Acting Chair at San Francisco State University, visited campus in January 2008. Dr. DeWitt wrote a thorough report in which she praised the faculty and staff of the Department of Chemistry and Biochemistry as “a united, energetic, hardworking, and dedicated group” with a “fantastic” record of accomplishment over the past five years. However, she cautioned that “the Department requires more support to maintain their current level of activity, to implement the changes in programs and curriculum outlined in their five year plan, and to effectively recruit new tenure-track faculty.” Several of the key points of the review are outlined below.

#### *Curriculum*

- The department needs more electives at both the undergraduate and graduate level. This will require more TT faculty and the necessary resources to support them.
- The department's plan to expand its GE offering and add an activity component to GE courses is an excellent idea. However, given the current lack of laboratory space and the strong demands on faculty time, the department will need to prioritize its allocation of space and where to spend the curricular development energy of its full time faculty.
- The department's plan to develop a MS Biochemistry degree is well motivated by demand. However, it must consider the impact this degree will have on its traditional MS Chemistry degree. One very strong MS Chemistry degree program may be more sustainable than two MS degree programs of unequal strength.

#### *Students*

- The department has made good progress in spreading the advising responsibilities for both undergraduates and graduate students across the entire faculty. However faculty is not being adequately compensated for their role in advising masters' students with their thesis projects.
- Students have expressed frustration at the limited availability of elective courses, difficulty in getting into certain required courses, and, in the graduate program, the insufficient space in faculty research laboratories. These problems may be relieved with future TT faculty searches.

#### *Faculty*

- All seven full time faculty members supervise student research projects in their laboratories. Over the past five years, 85 undergraduates and 30 graduate students have participated in research projects with a faculty mentor. The faculty receive 2 WTU per year for research mentoring activities, which is insufficient, given the amount of time required for these activities in a given quarter and the fact that faculty are doing this every quarter. It is recommended that research-active faculty receive a minimum of 9 WTU assigned time per year for supervision of research students at the undergraduate and graduate level.
- The faculty currently has insufficient office and research space. Full time faculty members should be given private offices and adequate space for a research laboratory.

#### *Staff*

- Increase staffing for the office to two full-time positions plus student assistants to handle routine day-to-day business and allow the administrative staff to use their expertise more effectively.

### *Resources*

- More full time faculty is needed in all areas to keep pace with the growth of programs and the demand for research opportunities in labs.
- Lab coordination units should be provided to support the proposed changes in general chemistry and biochemistry labs. Lab coordination units should be provided routinely because of the work involved in ensuring that multiple sections of a lab course are running smoothly with properly trained instructors so that a consistent experience is provided to all students.
- Funds are needed to maintain, repair, and upgrade classroom laboratory instruments.
- The College should negotiate the return of indirect costs on grants so that research activities in the Department of Chemistry and Biochemistry can be supported. Such activities include travel to present research, instrument service contracts and repair, summer fellowships for students, and assigned time for faculty.
- The library funds for the department (around \$1,200) are inadequate to maintain a viable collection of books on modern topics in Chemistry and Biochemistry. An increase in funding of one order of magnitude would be ideal and greatly improve the collection.

### **3.2 Response to the outside reviewer's Report**

*Curriculum* - The department agrees that expanding the curriculum will depend largely on hiring more TT faculty. Current plans are to hire three new faculty members in the next two years. In the meantime, the department will add electives in the form of low unit courses, seminar courses, and joint courses with the department of Biology. The department feels an obligation to expand its GE offering and will rely on lecturers to teach these classes. Lab space outside the department will be used to support the activity portions of the class. The program has reassessed its plan to offer a new MS in Biochemistry, and will create a non-thesis option in biochemistry for the traditional MS in chemistry degree instead.

*Students* - The department plans to update its website to make advising information and contacts readily accessible to students. It will also use its core major classes to disseminate information to its undergraduate students. The difficulty graduate students have in finding a research position will be partly alleviated by hiring more TT faculty. All entering MS students will continue to be guaranteed a spot in the non-thesis option.

*Faculty* - The department concurs with the reviewer's recommendation to increase the release time allotted for supervisory units. The fields of chemistry and biochemistry require a great deal of hands-on supervision of students working in research labs. The department believes that 2 units per quarter (for a total of 6-8 units) per faculty member rather than the 2 units per year currently available would be more reflective of the time put into the supervision of research students. The reviewer also recognized that space is a major limitation in the department. In order to attract more research-active faculty, more research lab space, shared instrument space, and private offices are needed.

*Staff* - The department agrees with the reviewer that two full-time staff positions are needed in the department office. The office workload has increased significantly over the last 5 years, because of rising enrollments and a 76% increase in the number of course sections offered. Work-study students and student assistants are used when special needs arise, but they are not able to handle most of the issues arising from increased enrollments (more complex scheduling, contracts for lecturers and teaching assistants, student registration problems, curriculum questions from prospective students, etc.).

*Resources* - The department recognizes the need to increase the number of TT faculty. The Dean of the College of Science has been very supportive of this goal and the faculty is confident that over

the next five years, they will be able to bring the number of faculty members to the necessary level. The department agrees that lab coordination units should be provided for instructors teaching and coordinating large courses with many lab sections. About five years ago, the department gave up (temporarily) its coordination units because of budget constraints. These units have never been restored. In this time of increasing FTES, the department agrees with the external reviewer that coordination units should be provided for the General Chemistry and Pre-Nursing Chemistry coordinators.

#### **4. PROGRAM'S FIVE-YEAR STRATEGIC PLAN (2008 – 2012)**

##### *Curriculum*

- Develop an option in Chemical Education for the Chemistry and Biochemistry BA degrees for students planning on becoming secondary school educators.
- Develop an option in Biotechnology for the Biochemistry BA to better serve students entering the biotechnology and pharmaceutical industries.
- Develop a joint BA Chemistry / Business degree.
- Modernize General Chemistry labs with new equipment and make computer analysis of data routine, when appropriate.
- Maintain and upgrade Biochemistry offerings to meet the increasing student demand and keep pace with the rapidly evolving field.
- Add major electives in organic and physical chemistry to meet the demand resulting from increased enrollment in both the undergraduate and graduate programs.
- Add an activity component to GE “Popular Topics” course.
- Increase upper division GE offerings.
- Teach the pre-nursing chemistry series on the Concord campus.
- Develop an MS Chemistry, option in Biochemistry, non-thesis degree.

##### *Students*

- Designate a faculty undergraduate coordinator, with assigned time for the task, who could help with general questions, freshmen advising, and with students considering transferring to CSUEB or changing majors.
- Increase administrative staff to two full-time positions to cut down waiting time for students with registration problems and questions regarding course offerings or prospective students needing direction to an advisor.
- Expand undergraduate laboratory space to meet growing enrollment.

##### *Faculty*

- Hire three new TT faculty in the next two years to meet the demands of enrollment growth.
- Increase faculty compensation for advising of student research projects above the current 2 WTU per year maximum.

##### *Resources*

- Acquire new equipment to be used in teaching in research laboratories including a fluorescence spectrometer, new probes for the NMR spectrometer, a microwave synthesizer, and an infrared spectrometer.
- Find more space for the department's expanding lab offerings and the research activities for its growing faculty. The department would also like to secure private offices for faculty whenever possible.

## **5. CAPR ANALYSIS OF THE PROGRAM'S FIVE-YEAR REVIEW**

The programs in the Department of Chemistry and Biochemistry have submitted an excellent five year report. The documents reveal a department that is strong in professional research yet still committed to maintaining a high quality curriculum backed by a detailed assessment plan. By several different measures the department has grown by about 50% in the last five years. During this same period the department saw a huge turnover in faculty: five professors left and five new TT faculty members were hired. Nevertheless, the department was able to fulfill many of the goals outlined in the last five year review. The department has laid out a clear vision for the coming five years in their strategic plan. Below are a couple of key recommendations for the programs as they move forward.

1. The department must aggressively pursue TT hiring in order to keep pace with enrollment growth. Faculty searches are intensive processes that will compete for the faculty's time with the other ambitious plans outlined above. Nevertheless, without adequate faculty, the outstanding quality of this program will be at risk of eroding.
2. The success of the chemistry and biochemistry programs is no doubt in large part due to the excellent training that these programs provide to their students. A vital part of these programs' curricula is the ability of students to work one-on-one with a faculty mentor in a research environment. For the past several years, faculty have received a maximum of 2 WTU per year as compensation for participating in this intensive mentoring process. However, the recent growth of the department has led to a substantial increase in the faculty workload which has not been accompanied by any changes in faculty compensation. For example, in 2002-03, 31 students signed up for special registration classes that involve one-on-one work with faculty. In 2007-08, this number increased by over five times to 176 students. CAPR recommends that the department work with the college administration to find a way to compensate faculty fairly for these activities.
3. The workload of the department staff has also increased significantly over the last 5 years. The large increases in enrollments have led to significantly more complex scheduling, more contracts for lecturers and teaching assistants, increased numbers of student registration problems, more calls, e-mails and drop-ins from prospective students, etc. Currently, there is 1.5 full time, permanent staff positions assigned to the Chemistry and Biochemistry department office and another 0.25 position on a temporary basis. CAPR recommends that the department negotiate with the University administration for 2.0 full time, permanent staff positions to keep up with their growing departments needs.

## **6. CAPR RECOMMENDATION FOR CONTINUATION OF THE PROGRAM**

CAPR recommends the continuation of the Chemistry and Biochemistry Programs without modification.

## **7. DATE OF THE PROGRAM'S NEXT ACADEMIC REVIEW**

The date of the next Five Year Review of the program is 2012-2013.