California State University, East Bay

Department of Chemistry and Biochemistry

Annual Report – Chemistry and Biochemistry Programs

2010 – 2011

Submitted to
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A. Self Study

At the suggestion of the Committee on Academic Planning and Resources of 2007-08, the Five Year Program Reviews for the Chemistry and Biochemistry Programs were combined into one document. The two programs are quite intertwined, since the undergraduate Biochemistry degrees (B.S. and B.A.) require many units of Chemistry and two of the three undergraduate Chemistry degree programs (B.S., B.A. B.S., Option in Forensic Science) require at least one Biochemistry course. The Chemistry Master of Science Degree program includes both Chemistry and Biochemistry Options. For these reasons I am also combining the Annual Reports for the two programs. Consequently, sections A and B are each two pages.

During this evaluation period (Spring 2010 - Winter 2011), the Chemistry and Biochemistry Department continued to make progress on the goals outlined in our CAPR Review of 2007-08 and we added some new goals. Because of the Provost's new Instructional and Research Equipment (IRE) Program, we were able to make significant progress on our 2007-08 goal of modernizing our General Chemistry laboratories and maintaining and upgrading our Biochemistry and Organic laboratories, in terms of the small equipment used frequently by the students. In response to Provost Houpis' Fall 2010 request for IRE Proposals, the Chemistry and Biochemistry faculty worked together to produce a large document justifying acquisition of nine types of equipment, seven targeted to upgrade the classroom laboratory experience for our students. We were informed in Winter 2011 that all seven classroom equipment requests were funded. This is providing a quantum leap in the quality of our programs. The General Chemistry labs will get 50 graphing calculators, each with the ability to continuously monitor data obtained with one of four different probes. This will bring our students into the 21st century by substituting old bulky equipment with sleek probes connected to graphing calculators that analyze and display the experimental data directly and can serve as computer interfaces. We will also upgrade the General Chemistry and Quantitative Analysis labs with new balances.

The Biochemistry labs will get mini-spectrophotometers run by laptop computers. For the first time each student group will have its own apparatus and be able to continuously monitor the data as it is generated. Other items include new pipetting devises for the Biochemistry labs, which the students are already enjoying, and a ultra-low temperature freezer to properly store unstable biochemical materials. The Organic Chemistry labs will receive two badly needed Infrared Spectrophotometers. The students taking the two capstone laboratory classes currently used to assess laboratory skills and analytical ability for the majors will enjoy the use of much of this new equipment. We expect the resulting improvements to generate added student enthusiasm and perhaps better assessment results in the coming years.

As stated in our Five Year Program Review faculty members submitted proposals to the Dreyfus Foundation and the National Science Foundation in hopes of obtaining funding for new High Performance Liquid Chromatography systems and a Fluorimeter. Neither proposal was funded. However, we did obtain older versions of these larger equipment items donated by local companies and our faculty and staff are working to get these classroom ready.

Having completed during 2009-2010 the stated goal of adding new B.A. Chemistry and B.A. Biochemistry Degrees with Options in Chemistry Education to our program, additional science education-related curriculum was added in 2010-11. Two new courses entitled Foundational Chemistry and Foundational Chemistry Laboratory were designed and established by faculty

members in the Department (Danika LeDuc and Tony Masiello). These are part of a new Certificate in Foundational Level General Science designed by Dr. LeDuc and approved by the Academic Senate in Winter 2011. The certificate program is funded in part by a grant from Bechtel and Broadmore and is designed for students who would like to teach middle school science and who currently have or plan to obtain their Multiple Subject teaching credential or a Single Subject teaching credential in a related field. This program was developed in response to the state's new Added Authorization in Foundational Level General Science. The new Foundational Chemistry course was also approved as an upper division general education course (B6).

During this review period budget cuts led to the loss of two release time units for the Department Graduate Coordinator and all supervisory units for faculty supervision of Master's degree students. There are currently approximately 43 students in the Master of Science Program in Chemistry. The seven regular faculty are receiving no compensation for supervising either thesis or non-thesis students, both of which require considerable time and effort. As a consequence the number of undergraduate students being given the opportunity to do supervised research with a faculty member has decreased significantly. Our accrediting agency, the American Chemical Society, strongly urges the bachelor's degree candidates be exposed to research. In our 2007-08 Five Year Program Review an important goal was to provide undergraduate research opportunities for our students and this goal was emphasized by the outside reviewer. The increased faculty workload resulting from loss of all supervisory support for the Master's program coupled with a diminished faculty to handle the university service work has forced a cutback in this important area.

During 2010-2011 the Department submitted requests for two new tenure track faculty positions, one in Biochemistry, the other in Analytical or Inorganic Chemistry. At the time of the 2007-08 Review, there were seven full time faculty in the department and one member in the Faculty Early Retirement Program (FERP). Since then one faculty member retired and one new faculty member was hired. Dr. Luibrand will complete his five years of FERPing this June. The statistics given in Part C are incorrect. Currently, there are seven full time tenured or tenure track faculty in the department, not eight. Nearly 50% of our FTES is taught by part-time lecturers. Dean Leung's calculations indicate that we will need three new faculty positions in order to achieve the CSU goal of 75% of the FTES taught by tenured or tenure track faculty. In meetings in Fall 2010, the Chemistry and Biochemistry faculty were unanimous in voting for the need for three new faculty positions, with highest priority for a biochemist, followed by an analytical/inorganic chemist and then an organic chemist. At the advice of Dean Leung we applied for two positions. The request for the Biochemistry position has been approved, pending budget considerations; the request for the Analytical/Inorganic chemist was not approved.

B. Summary of Assessment Results

The Chemistry and Biochemistry programs are relatively strong, in our view. The current tenured and tenure track faculty are all excellent teachers and all have active research programs. It is unfortunate that we have only been able to add one tenure track faculty member over the last five years, a period during which we lost three regular faculty and two FERPers. However we have been fortunate in finding some very able part-time lecturers who are covering about half of our classes, including a number of majors-level courses. Thus we are doing are best to maintain our tradition of quality instruction during this difficult budget period. The overall student evaluations for our courses and our instructors have remained relatively high. For 2010-11 the average student

rating for our courses was 1.56 and the average student rating for our instructors was 1.46 (on a 4 point scale where 1 means "outstanding" and 4 means "poor").

The Assessment Program for student performance by our majors is based on lecture and laboratory courses in Organic Chemistry and Biochemistry. The American Chemical Society now requires at least one course in biochemistry for the Chemistry majors and most take the General Biochemistry lecture course evaluated in our Assessment Program.

Assessment Results for 2010-2011

i) Organic Chemistry Lecture Series

Student Learning Outcomes - To be able to predict physical properties of organic compounds and common organic reaction mechanisms; to use spectroscopic methods to identify organic structures

Assessment Method and Data - At the end of the year-long organic chemistry series, the students were given the standardized American Chemical Society (ACS) Organic Exam. This test is administered at universities throughout the nation and is considered to be the standard for achievement in organic chemistry. The average scores for the chemistry and biochemistry majors for 2010 were compared with the national distribution and are reported as national percentiles in Table 1 (Appendix 1). The results for earlier years are shown for comparison. The number of majors who took the exam ranged from 12-24 over the period from 2004 through 2010.

ii) Organic Chemistry Laboratory Capstone Assignment

Student Learning Outcomes - To be able to carry out standard organic laboratory techniques, demonstrate knowledge of chemical reactivities, obtain and interpret spectroscopic data, and use problem solving and critical thinking skills to identify two chemical unknowns

Assessment Method and Data - A capstone laboratory assignment to be accomplished over several periods serves as the performance test. Students are asked to identify two unknown chemicals using various reactions and techniques learned during the year of organic chemistry laboratory. Assessment results are recorded as the percentage of student majors who correctly identify one or both of the chemical unknowns (see Table 2, Appendix).

Assessment Analysis for Organic Chemistry Courses for 2010

Over the years 2004-2009 the ACS Organic Exam results have been near the national average of 50th percentile (Table 1, Appendix). Our goal has been to maintain this level of performance and break the 50^{th} percentile barrier. In 2010 the average score for our majors dipped to the 34th percentile. A similar trend is observed for the Capstone Laboratory Assignment (Table 2). The percentage of students who identified both unknowns dropped to 48, compared with 70 and 74% for the two preceding years. The reason for the lower scores is not obvious. The courses were taught by the same instructors as in earlier years using similar teaching methods. One possibility is the increased number of majors, 25 in 2010 as compared with 10 and 17 for 2008 and 2009, respectively. It's possible increased admissions led to a weaker student population. Another

possibility is random fluctuation in student response to our teaching program. Before making changes in what we consider to be an excellent Organic Chemistry program, we plan to wait for the Spring 2011 data. If those numbers remain lower than in the 2004-2009 period, we will re-evaluate the program with a view toward better reaching the weaker students.

iii) General Biochemistry Lecture Series

Student Learning Outcomes – To understand key information and concepts in biochemistry. Objectives relating to each major topic in the year-long biochemistry series were outlined and selected outcomes were assessed. The results are given in Table 3, Appendix.

Assessment Method and Data - Specific questions testing the learning outcomes were embedded into course exams. These took the form of short essay, problem solving or multiple choice questions. The answer was scored as correct when 75% or more of the possible points were assigned.

iv) Advanced Biochemistry Laboratory Course

Student Learning Outcomes – 1: Understand the theoretical basis for cloning PCR products into a reporter plasmid; 2: Know the theoretical basis and practical details of performing a "Western Blot" experiment

Assessment Method and Data - Questions relating to the learning outcomes were embedded into laboratory quizzes. These were mostly in a short essay format with several parts and were designed to evaluate student understanding of key concepts and techniques covered in the course. The answers were scored as correct when 75% of the possible points were assigned.

Assessment Analysis for Biochemistry Courses

As shown in Table 3, between 70 and 85 percent of the chemistry and biochemistry majors mastered the designated outcomes for the biochemistry lecture series that were rated as "things every working biochemist should know." We conclude that our majors are doing well, but there is room for improvement. The students also did reasonably well on the more difficult embedded questions (59-69% with the correct answer). For 2010-2011 we have instituted an outline homework/quiz system designed by the book publisher. It will be interesting to see if access to a larger variety of practice problems and the addition of multiple short quizzes will improve student performance on the embedded questions.

The assessment results for the Capstone Biochemistry Laboratory course have been quite consistent since 2004-05 when changes were made in the course format (Table 4, Appendix). For 2010 the majority of the students (75-82%) achieved the defined student outcomes. We feel this is a strong showing but of course there is still room for improvement and we are working on classroom strategies to help even more students achieve the outcomes.

C. Program Data Summary

California State University, East Bay

APR Summary Data

Fall 2005 - 2009

Chemistry and Biochemistry					
	Fall Quarter				
	2005	**2006**	**2007**	**2008**	**2009**
A. Students Headcount					
1. Undergraduate	141	136	140	146	148
2. Postbaccalaureate	11	9	9	9	12
3. Graduate	25	36	47	57	43
4. Total Number of Majors	177	181	196	212	203
	College Years				
B. Degrees Awarded	**04-05**	**05-06**	**06-07**	**07-08**	**08-09**
1. Undergraduate	30	29	35	29	28
2. Graduate	5	4	11	7	12
3. Total	35	33	46	36	40
	Fall Quarter				
	2005	**2006**	**2007**	**2008**	**2009**
C. Faculty					
Tenured/Track Headcount					
1. Full-Time	7	7	7	8	8
2. Part-Time	2	2	0	0	0
3a. Total Tenure Track	9	9	7	8	8
3b. % Tenure Track	60.0%	64.3%	41.2%	40.0%	40.0%
Lecturer Headcount					
4. Full-Time	0	0	0	0	0
5. Part-Time	6	5	10	12	12
6a. Total Non-Tenure Track	6	5	10	12	12
6b. % Non-Tenure Track	40.0%	35.7%	58.8%	60.0%	60.0%
7. Grand Total All Faculty	15	14	17	20	20
Instructional FTE Faculty (FTEF)					
8. Tenured/Track FTEF	8.5	8.5	6.4	5.0	6.3
9. Lecturer FTEF	3.8	3.7	8.1	9.4	6.6
10. Total Instructional FTEF	12.3	12.2	14.4	14.3	12.9
Lecturer Teaching					
11a. FTES Taught by Tenure/Track	163.3	180.4	135.5	116.0	152.7
11b. % of FTES Taught by Tenure/Track	71.3%	73.6%	52.7%	41.3%	52.2%
12a. FTES Taught by Lecturer	65.7	64.9	121.5	164.8	140.0
12b. % of FTES Taught by Lecturer	28.7%	26.4%	47.3%	58.7%	47.8%
13. Total FTES taught	229.0	245.3	257.0	280.8	292.7
14. Total SCU taught	3435.0	3679.0	3855.0	4212.0	4390.5
D. Student Faculty Ratios					
1. Tenured/Track	19.2	21.2	21.3	23.3	24.1
2. Lecturer	17.3	17.5	15.1	17.6	21.2
3. SFR By Level (All Faculty)	18.6	20.1	17.8	19.6	22.6

4. Lower Division	22.7	23.9	20.4	23.6	26.3
5. Upper Division	16.7	19.1	18.4	18.7	19.5
6. Graduate	5.9	9.1	5.4	6.0	11.2
E. Section Size					
1. Number of Sections Offered	59.0	64.2	80.0	82.0	79.0
2. Average Section Size	30.4	31.9	26.2	26.7	30.8
3. Average Section Size for LD	33.6	34.5	29.6	29.1	33.8
4. Average Section Size for UD	27.7	29.0	23.7	23.9	25.2
5. Average Section Size for GD	13.0	26.0	12.3	14.0	26.0
6. LD Section taught by Tenured/Track	9	11	3	3	10
7. UD Section taught by Tenured/Track	23	20	25	12	20
8. GD Section taught by Tenured/Track	9	16	19	22	16
9. LD Section taught by Lecturer	15	12	25	35	28
10. UD Section taught by Lecturer	4	6	7	10	6
11. GD Section taught by Lecturer	0	0	1	1	0

Source and definitions available at: http://www.csueastbay.edu/ira/apr/summary/definitions.pdf

	Fall Quarter				
Headcount Enrollment	**2005**	**2006**	**2007**	**2008**	**2009**
Chemistry					
1. Undergraduate	50	46	56	66	56
2. Postbaccalaureate	2	1	3	4	6
3. Graduate	25	36	47	57	43
4. Total Number of Majors	77	83	106	127	105
Biochemistry					
1. Undergraduate	91	90	84	80	92
2. Postbaccalaureate	9	8	6	5	6
3. Graduate	0	0	0	0	0
4. Total Number of Majors	100	98	90	85	98

	College Years				
Degrees Awarded	**04-05**	**05-06**	**06-07**	**07-08**	**08-09**
Biochemistry					
1. Undergraduate	21	21	27	22	20
2. Graduate	0	0	0	0	0
3. Total Number of Majors	21	21	27	22	20
Chemistry					
1. Undergraduate	9	8	8	7	8
2. Graduate	5	4	11	7	12
3. Total Number of Majors	14	12	19	14	20

Appendix A

Table 1. Results of Capstone Organic Lecture Assessment for 2004 – 2010

Year	Percentile
2004	46
2005	50
2006	42
2007	47
2008	N/A
2009	45
2010	34

Note: In 2008 we beta tested a new exam so there were no national norms available.

Table 2. Results of Capstone Organic Laboratory Assignment for 2004 – 2010

Year	# of Chem/Biochem Majors	# with both correct	% Both Correct	# with at least one correct	% At least one correct
Sp 2004	18	13	72	17	94
Sp 2005	22	9	41	22	100
Sp 2006	22	18	82	22	100
Sp 2007	12	5	42	10	83
Sp 2008	10	7	70	9	90
Sp 2009	17	10	74	14	95
Sp 2010	25	12	48	21	84

Table 3. Assessment Results for Chemistry and Biochemistry Majors in the General Biochemistry Lecture Series, 2009 – 2010.

Learning Outcome	Embedded Question No.	No. of students with correct answer	No. of students with incorrect answer	Percentage of students with correct answer
Know the properties of enzymes	1*	21	6	78
	2*	19	8	70
	3	16	11	59
Understand the basics of enzyme kinetics	1*	23	4	85
	2*	19	7	73
	3	17	9	65
Know structural details of the nucleic acid molecules DNA and RNA	1*	21	8	72
	2	20	9	69

*Questions every working biochemist should be able to answer.

Table 4. Assessment Results for Chemistry and Biochemistry Majors in Advanced Biochemistry Laboratory, Spring 2004-2010.

Year	# of Chem/Biochem Majors	No. Correct Answer – Outcome 1	% Correct – Outcome 1	No. Correct Answer – Outcome 2	% Correct – Outcome 2
Sp 2004	23	12	52	13	57
Sp 2005	21	16	76	11	52
Sp 2006	22	16	73	15	68
Sp 2007	19	16	84	15	79
Sp 2008	27	22	81	20	74
Sp 2009	29	22	76	21	72
Sp 2010	28	23	82	21	75