California State University, East Bay

Five Year Program Review for Department of Chemistry and Biochemistry

2012-2013

Self Study and (Amended) Five-Year Plan approved by faculty: May 14, 2013 (by a vote of seven to zero)

External Reviewer Report received by the program on: April 15, 2013

Program's Response to External Reviewer's Report completed on: May 13, 2013

Complete 5-Year Program Review Report submitted to CAPR on: May 15, 2013

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1. Summary

The Department of Chemistry and Biochemistry offers seven undergraduate degrees and an M.S. degree. The B.S. Chemistry degree is accredited by the American Chemical Society (ACS). The ACS authorizes the chair of an ACS-approved program to certify graduating students who complete a bachelor's degree meeting the ACS guidelines. A certified degree signifies that a student has completed an integrated, rigorous program which includes introductory and foundational course work in chemistry and in-depth course work in chemistry or chemistry-related fields. The ACS does not have an accreditation process for our other degree programs, and the other programs are not accredited by an external agency. As we have done in the past to simplify the review process, we include all eight degrees in this Five Year Review following the CAPR format for Academic Programs without external accreditation.

Self-Study

The Department of Chemistry and Biochemistry accomplished most of the plans outlined in the previous Five Year Plan (2007). In some cases the plans were slightly modified. Significant changes were made to improve and update the curriculum. The department acquired several new instruments for research and for use in the teaching laboratories. Research activity by the faculty and their students also remained high.

Curriculum changes implemented during the past five years included adding an MS degree in Chemistry with a Biochemistry Option – Plan B (Comprehensive Review). Chemistry Education options were also added to both the B.A. Chemistry and B.A. Biochemistry degrees. Several new courses were introduced: Instructional Activities in Chemistry to support the new Chemical Education options, Foundational Chemistry as a GE elective and to prepare teachers for the CSET General Science Subtests in Chemistry, and Senior Thesis as an upper division major elective.

New instrumentation acquired during the last five years included a spectrofluorometer with anisotropy capabilities, a Bruker 70V infra-red spectrometer, a physiosorptive analyzer from Micrometrics, a glacier fiber spectrometer for Raman spectroscopy, and a microplate reader with UV/VIS, fluorescence and luminescence detection. Two in-house instruments were upgraded: new software was acquired for a high performance liquid chromatograph (HPLC) and the 500 MHz Nuclear Magnetic Resonance (NMR) spectrometer was upgraded to a three channel system by the purchase of a triple resonance probe. Among the new instruments purchased to improve the teaching laboratories were Thermo Fisher NanoDrop 2000c devices interfaced to laptop computers to measure UV/VIS absorption, new nucleic acid electrophoresis apparatuses, new protein electrophoresis apparatuses, and new western blotting apparatuses. The general chemistry and quantitative analysis labs were improved with Vernier probes used for recording and graphing temperature and pH changes over time, new analytical balances and new platform balances. Two new infra-red spectrometers capable of running solid and liquid samples, new melting point apparatuses, and a new refractometer were added to the organic chemistry laboratories.

The plan to hire a new tenure-track faculty member in the area of physical chemistry was realized in 2008. Requests for two more positions were approved and there are two searches in progress this year, one for a biochemist and the other for an analytical or inorganic chemist. During the last five years, research and professional activities of the department faculty continued at a high level. Cumulatively, the faculty of the Chemistry and Biochemistry Department were awarded 27 extramural and CSU or CSUEB grants and published 23 articles. The faculty also supervised 66 undergraduate and 48 Master's students on research projects, and 63 students working under faculty supervision made presentations at scientific meetings.

The department worked to achieve its mission of preparing the chemistry and biochemistry majors for work or advanced study, providing a foundation in chemistry or biochemistry for students in related majors, and making chemistry accessible to non-majors in the General Education courses. We monitored and assessed the performance of our major students in three key areas: organic chemistry, biochemistry, and physical chemistry. The assessment data demonstrates that our students are meeting the standards set by the goals in our assessment plan. The requirements of our degree programs are similar to those of chemistry departments at other CSU and UC institutions.

Statistics for the last five years indicate that the number of Chemistry and Biochemistry majors has increased at the same rate as that of the overall University enrollment. There was no discernable trend from year to year in the ethnicity of the majors. Total instructional FTEF numbers have remained fairly constant over the last five years. Overall SFR for the department, on the other hand, has increased over the past five years. While the number of course sections offered by our department decreased slightly over the last five years, the average section size for all courses increased.

Plan

Over the next five years we plan to implement several changes to our curriculum. We plan to modify three of the degree programs to meet the CSU-wide goal of 180 maximum total units. In particular, the total units required for the B.S. Chemistry, B.S. Chemistry-Option in Forensic Science, and B.S. Biochemistry degree programs will be decreased. Due to increasing enrollment, we plan to teach the inorganic chemistry series (CHEM 4161 and CHEM 4162) every year instead of the current alternate year schedule. We also plan to provide more 6000-level courses for the Master's program by increasing the number of times the advanced topics courses CHEM 6310 and CHEM 6410 are taught each year, increasing the number of sections of the Graduate Seminar class (CHEM 6820), and by introducing a new course in spectroscopy. The existing course Instructional Activities in Chemistry (CHEM 4400) will be added as a major elective to the B.S. Chemistry, B.A. Chemistry, and B.A. Biochemistry degree programs. This will give students in these degree programs the opportunity to gain credit for service learning.

We plan to revise both the lecture and laboratory of Introductory Chemistry (CHEM 1100) to better serve the liberal studies majors for whom the course is required. We also plan to continue to upgrade the laboratory curriculum and instrumentation for all

of our major classes. The new spectrofluorometer will be incorporated into the Instrumental Methods of Analysis laboratory. New experiments are also planned for the General Biochemistry laboratory and Organic Chemistry laboratory.

We also plan to continue to upgrade the instrumentation used in teaching and research. We plan to purchase microwave synthesizers and new gas chromatographs for the Organic Chemistry laboratory. We also hope to obtain a new HPLC with fluorescence detection to be used in the Biochemistry laboratory and for use in research. Funding for service contracts to support the maintenance of the new instruments, as well as for the continued maintenance of existing instruments, will be requested.

One of our goals is to increase the number of biochemistry and chemistry courses taught by tenured or tenure-track faculty. We also need more tenure track faculty to provide adequate research opportunities for our undergraduate and graduate student majors. We are currently conducting searches for new faculty, one in the area of biochemistry and the other in analytical or inorganic chemistry. Over the next five years, we plan to submit requests for additional faculty, in the areas of organic chemistry, analytical or inorganic chemistry, depending on the outcome of the current search, and possibly biochemistry. Research laboratory space and office space will be needed for the new faculty hires. It is also necessary to find some mechanism for providing all tenured and tenure-track faculty with release time to mentor undergraduate and graduate research students and to advise Plan B (non-thesis) graduate students.

In addition to faculty hires, we also need to hire a replacement for one of our stockroom prep technicians who sadly died this past year. Due to his untimely death and the retirement of the Chemistry Department Stockroom Manager in 2009, whose position was not replaced, we are currently very short staffed in the chemistry stockroom. The lack of adequate stockroom staff has had a negative impact on our ability to update and improve our laboratory curriculum.

2. Self-Study

2.1. Summary of Previous Review and Plan

Over the last five years, significant progress toward the goals outlined in our CAPR Review of 2007-08 has been made. The 2007-08 Five Year Plan noted the trend of an increasing student population and laid out plans to accommodate this increase in terms of space, resources and curriculum. The plans also contained changes to the curriculum that considered changes in the field to ensure that our students were gaining the theoretical and practical knowledge needed for employment or further education. The 2007-08 Plan recognized the need to hire more tenure track faculty due to planned retirements and the untimely death of a faculty member, as well as the increase in undergraduate and M.S. students majoring in chemistry and biochemistry. This summary outlines the major aims of the 2007-08 Plan and the progress made toward implementation.

a) Curriculum

In accordance with the 2007-08 Plan, we added an M.S. degree in Chemistry with a Biochemistry Option – Plan B (Comprehensive Review). This degree proved immediately popular and currently slightly more than half of our Plan B M.S. students are pursuing this option. We did not introduce any new 6000-level courses to our graduate curriculum but instead offered the proposed courses of Molecular Spectroscopy, Bioorganic Chemistry and Nanotechnology through our existing Advanced Topics Series (CHEM 6310, 6410, and 6510).

As delineated in the 2007-2008 Plan, we began to develop specific options for our B.A. degree programs to satisfy the demand for graduates with interdisciplinary skills. We added a B.A. in Chemistry with a Chemistry Education Option and a B.A. in Biochemistry with a Chemistry Education Option as proposed. These degree programs will serve students who plan to also do a Teaching Credential Program with the goal of becoming a high school chemistry teacher. A new course, CHEM 4400, Instructional Activities in Chemistry, was added to support these new B.A. options. We did not add a B.A. Biochemistry, Option in Biotechnology degree nor a joint B.A. Chemistry / Business degree as planned, but instead decided to wait until the number of majors in the degree grew to justify more options.

Also as planned in the 2007-08 Review, we reduced the number of required units in the B.S. Chemistry with Option in Forensic Science degree by removing the 3-4 units of electives in chemistry or criminal justice. These were not really essential to the program, but simply added interesting coursework. We did not increase the number of units for Advanced Biochemistry Lab (CHEM 4431) as planned because the B.S. Biochemistry degree is over 180 units. Although not in the Plan, we added a new course CHEM 4811, Senior Thesis. This course was added to encourage students to write a

senior thesis based on their undergraduate research. Up to two units of CHEM 4811 can be applied as elective units toward the B.S. Chemistry or B.S. Biochemistry degree.

Two new non-majors courses, CHEM 3011, Foundational Chemistry, and CHEM 3012, Foundational Chemistry Laboratory were also added to the curriculum. CHEM 3011 is an on-line course, designed to prepare pre-service and in-service teachers for the CSET General Science Subtest in Chemistry with the goal of obtaining a Foundational Science Credential. CHEM 3012 is an on-the-ground laboratory course that supplements CHEM 3011. CHEM 3011 is approved as an upper division science GE elective and increases our upper division GE offerings as proposed in our 2007-2008 Plan. Although not in the plan, the format for the non-major organic chemistry series CHEM 2301, 2302 was modified to provide a laboratory experience coordinated with the lecture throughout the series.

b) Concord Campus

The 2007-2008 Plan proposed to offer Basic Chemistry I and II (CHEM 1601 and 1602) on the Concord Campus to support the Pre-Nursing curriculum as part of the Concord arm of the Nursing Program. The Basic Chemistry series is now established on the Concord Campus and has been taught every year, with the exception of 2009-2010, since 2008.

c) Faculty

At the time of the 2007-08 Review, the department consisted of seven tenure track faculty members and one retired member in the Faculty Early Retirement Program (FERP). Since Fall 2008, the retired faculty member completed the FERP, one additional faculty retired without opting to enter the FERP, and one new tenure track faculty was hired. Currently there are seven full time tenure track faculty in the department. Two new tenure track searches are on-going, one for a biochemist and one for an analytical / inorganic chemist.

d) Equipment and Facilities

The 2007-2008 Plan identified a critical need for additional research and equipment space due to an increase in research active faculty. A shortage of space is an on-going problem in the College of Science that affects other departments as well and has not been resolved.

Over the last five years, the department has made substantial progress in acquiring new instrumentation for research and to enhance our teaching laboratories. A new spectrofluorometer with a temperature controller and anisotropy capability was purchased through the Academic Affairs A2E2 funding program. A new Bruker 70V infra-red

spectrometer was purchased with start-up funds for our new physical chemist. The software on our HPLC was upgraded through the College of Science Equipment Repair Funds. The 500 MHz Nuclear Magnetic Resonance (NMR) spectrometer was also upgraded to a three channel system and a triple resonance probe was purchased for it. New equipment obtained during this period also included a physiosorptive analyzer from Micrometrics and a glacier fiber spectrometer for Raman spectroscopy. A microplate reader with UV/VIS, fluorescence and luminescence detection was also acquired. Together with the Department of Biological Sciences, we were able to purchase a new laboratory steam sterilizer.

Significant improvements were made to the instrumentation used in almost every laboratory course we teach. The biochemistry teaching labs were upgraded by replacing analog Spec20 visible spectrometers with Thermo Fisher NanoDrop 2000c devices. The NanoDrop devices are used in combination with laptops for several experiments, including determination of protein concentration via absorption in the UV range, Bradford assays, enzyme kinetic measurements, determination of molar absorptivity, and analysis of gel filtration fractions. This instrument replacement made measurements in the UV range in tiny volumes possible and greatly enhances kinetic measurements via direct monitoring and software driven data analysis. The biochemistry labs were also upgraded with new nucleic acid electrophoresis apparatuses, new protein electrophoresis apparatuses, and new western blotting apparatuses.

Vernier probes used for recording and graphing temperature and pH changes over time were purchased and are in use for multiple experiments in both General Chemistry and Quantitative Analysis Labs. New analytical balances were purchased for the Quantitative Analysis Lab classes, and new balances were also added to the General Chemistry Labs.

Over the past couple of years, the department has increased the number of organic lab classes that run simultaneously, and we currently have three rooms set up with equipment in which organic chemistry can be taught. To decrease waiting times for shared pieces of equipment, two new melting point apparatus and one new refractometer were added to the organic labs, purchased through College of Science Program Enhancement Funds. In addition, two new infra-red spectrometers capable of running solid and liquid samples were added to replace a 25 year old infra-red spectrometer that was no longer functional or supported by the manufacturer.

e) Research and Other Professional Activities

Research activity in the department during the past five years has continued at a high level. Drs. Groziak, Kim, Kotchevar, LeDuc, Masiello, McPartland, and Sommerhalter have all held multiple CSU Faculty Support Grants during this five year period. Dr. Groziak has been the recipient of a Sieber Award. Dr. Kim held an NIH-MBRS grant and a Sieber Award. Dr. Masiello has obtained funding from CSUPERB and was a co-PI on an NSF Major Research Instrumentation grant to purchase a Femtosecond Optical Frequency Comb and Terrahertz Spectrometer. Dr. LeDuc obtained instrument time grants from Stanford Synchroton Radiation Lab (SSRL) and was awarded a CSUPERB grant, a Sieber

Interdisciplinary Award, and a CSU-ARI grant. Dr. LeDuc has also been on three grants from the Bechtel Foundation for STEM education. Dr. Sommerhalter has held a CSUPERB grant, a Cottrell College Science Award, and a COAST Collaborative Incentive Award. Dr. McPartland has held a grant from the John Muir Group for a feasibility study for a new clinical science laboratory science training program. Cumulatively, the Department of Chemistry and Biochemistry faculty published 23 papers in the last five years.

Student involvement in undergraduate research and research for Plan A (thesis option) M.S. degrees has remained high. During the past five years, approximately 66 undergraduates have participated in undergraduate research with a faculty advisor. Approximately 48 M.S. students conducted research with a faculty member. This research activity has led to 63 student presentations at national and local scientific meetings.

The Faculty of Chemistry and Biochemistry Department also have been very active in external professional activities. Dr. Groziak and Dr. LeDuc have been members of the Faculty Consensus Group for CSUPERB. Dr. Masiello served on the Council of Undergraduate Research. Dr. Groziak was a reviewer for NIH Synthetic and Biological Chemistry Study sections and for CSUPERB grants and meeting abstracts. Dr. Sommerhalter was an NSF proposal reviewer and reviewed grants for CSUPERB. Dr. LeDuc was a reviewer for CSUPERB travel grants. She also organized an invited lecture and meeting on campus for the ACS Women's Chemist Committee. Dr. McPartland organized a meeting of the Hospital Council of Northern on the Hayward campus and a meeting of the Central California the East Bay Hospital Laboratory Directors and Workforce Planners on the Oakland campus.

f) Student Achievement

During the past five years our undergraduate and Master's level students have continued to demonstrate impressive achievements. Each year several of our students were admitted to Ph.D. programs or professional schools. Sixteen students received Associated Student Fellowship or Scholarship awards for research projects. Two students won Harrington awards for outstanding M.S. thesis. Two students were awarded COAST student awards. One M.S. student won the CSUPERB Teaching Award. One of our undergraduates earned a Golden Key Research award, and another received a CSUPERB travel grant. Two students were awarded McNair scholarships.

2.2. Curriculum and Student Learning

a) Assessment of Program

A copy of the program's Outcomes Assessment Plan can be found in Appendix A. As indicated in the department mission statement, our primary function is to provide a strong education in chemistry and biochemistry that prepares students to work and thrive

in society. For our chemistry and biochemistry majors, we strive to provide a firm grounding in the important disciplines of chemistry - inorganic, analytical, organic, physical and biochemistry. The types and numbers of courses in each of these areas are geared to the particular major and option in our curriculum. We recognize the importance of emphasizing the use of modern laboratory techniques and relevant instrumentation in our laboratory classes. We also understand the value of research experience in the training of chemists and biochemists and therefore encourage our advanced undergraduates and Master's students to participate in faculty sponsored research projects or outside internships.

All our courses emphasize problem solving, critical thinking skills, as well as the use of the scientific method in analyzing chemical hypotheses and data. We also encourage students to think critically about the use of chemicals in society and about the responsibility of scientists to contribute to societal issues relating to chemistry and biochemistry. We believe these skills are essential for proper training of competent scientists and responsible members of society.

The first part of our assessment plan outlines the broad objectives for each degree program and how the objectives are measured. The second part of the plan lists specific course objectives and how they are measured.

A summary of the assessment data obtained and an analysis of what has been learned from this information and steps taken are described in the Assessment of Learning Outcomes for Chemistry and Biochemistry Majors document in Appendix B. Although the Program Assessment Plan outlines methods for analyzing a variety of upper division courses, we have emphasized the assessment in the organic chemistry and biochemistry areas. These areas are the basis of our assessment of the Chemistry and Biochemistry Programs, because they contain the core courses experienced by all majors in these programs regardless of Option. In particular, CHEM 3303 (Organic Chemistry) serves as the capstone course for the B.S. and B.A. Chemistry Degrees and CHEM 4431 (Advanced Biochemistry Laboratory) serves as the capstone course for the B.S. and B.A. Biochemistry Degrees. In addition we also include the data from the area of physical chemistry. The physical chemistry series (CHEM 3511-12-13) is taken by all of our B.S. Chemistry and Biochemistry majors. These three areas of specialization also have the most consistent data tabulation over the last five years.

Appendix B describes data gathered and analyzed for the organic chemistry lecture and lab series (CHEM 3301-02-03), the biochemistry lecture series (CHEM 4411-12-13), an advanced biochemistry lab course (CHEM 4431), and the physical chemistry lecture series (Chem 3511-12-13). The data for the organic lecture series is obtained from the standardized ACS organic exam, which is given as the final exam for the third course in the series. This allows us to compare results from one year to the next and to compare our results to the national norms. Data collected over the last four years reveals that although our averages have a great deal of variability from year to year, many of our students do exceed the national average. Organic laboratory skills were assessed through a capstone experiment involving identification of two unknown compounds. Results have

also varied somewhat over the past five years, but the majority of students have been able to identify one of the two unknowns.

Assessment for the biochemistry lecture material is based on answers to specific questions embedded into course exams for the General Biochemistry lecture series and for the Advanced Biochemistry Laboratory course. Comparable questions are used each year. Over the past five years student performance on a total of eleven outcomes representing a broad spectrum of topics in biochemistry was monitored. For most of the topics, between 60 and 80 percent of the biochemistry majors achieved the designated outcomes, indicating that a majority of the students are mastering the key concepts. For a few objectives significant variability was observed from year to year. This is probably attributable to the difficulty of the concept and is where the instructors will concentrate more effort in the coming years. They will also work to bring the percentages for all of the outcomes up to 80% by continuing to experiment with innovative teaching techniques.

To assess laboratory analytical skills for the biochemistry majors a capstone exercise is monitored in the Advanced Biochemistry Laboratory course. Several of the outcomes listed in the Program Assessment Plan are incorporated into a five week long series of experiments with the ultimate goal of localizing an RNA initiation site on *E. coli* DNA. The students are then asked to use their data and that generated by other members of the class to identify the RNA initiation site and to explain the reasoning by which they reached their conclusion, both on the final exam and in their laboratory notebooks. Over the period from 2008 to 2012 the percentage of students able to demonstrate the measured analytical skills was always near 80%, with a range of 74% to 83%. This indicates that the majority of the biochemistry majors are developing the desired critical thinking skills.

The physical chemistry assessment data presented is based on three learning outcomes through embedded questions in the final exams for each quarter of the series. In particular, data was collected to assess whether students met the learning outcomes of 1) being able to explain why the internal energy of an ideal gas is a function only of temperature, 2) being able to determine the force constant and bond length given the vibrational and rotational energy of a molecule in wavenumbers, and 3) being able to identify the molecular point group of a molecule. Over the past five years, the percentage of students able to demonstrate mastery of these outcomes varied from year to year. However, many of the students were able to satisfactorily answer these questions.

b) Assessment of General Education Programs

Student content knowledge gains are being assessed in Chemistry courses meeting General Education requirements by a number of different means. The General Chemistry series, CHEM 1101, 1102, and 1103, has been evaluated over the past five years through the use of essentially equivalent final examinations developed to match the course-specific learning outcomes of each course. No significant differences have been observed

in the year-to-year performance of the students in these courses as measured by the final examination scores.

A different method has been used to assess student learning gains in the online Foundational Chemistry course (CHEM 3011). A pre-test and isomorphic post-test (as the final exam) were administered through the Mastering Chemistry website provided by the publisher of the textbook for the course. Since this class is designed to prepare students to pass the General Science subtest in Chemistry and to teach middle school science, questions were chosen that closely represent the topics covered in the exam and those in the K-8 California Science Standards. In 2010, the average score on the timed on-line pre-assessment exam was 55%, and the average on the final exam was 93%. In 2011, the results were very similar: a pre-test average of 58% rising to a post-test average of 89%. This suggests significant content gains over the period of the course. The results are displayed in Appendix C.

In Fall 2012, a similar method of assessment was implemented in both CHEM 1101 and CHEM 1100 (Introduction to College Chemistry). In the case of CHEM 1101, the questions were taken from the Chemical Concept Inventory that most closely matched the course-specific learning outcomes. The questions on the pre-tests will be embedded in the final exams, and a determination of student learning gains will then be conducted.

c) Comparison of Degree Programs and Course Offerings to Other Institutions

The Department of Chemistry and Biochemistry offers a B.S. degree in Chemistry (ACS certified), a B.S. in Chemistry with a Forensic Science Option, a B.S. degree in Biochemistry, a B.A. in Chemistry, a B.A. in Biochemistry, a B.A. in Chemistry with a Chemistry Education Option, a B.A. in Biochemistry with a Chemistry Education Option, and a Minor in Chemistry. The Department offers the following M.S. degree options in Chemistry: the Plan A (Thesis), an M.S. degree in Chemistry with a Biochemistry Option – Plan A (Thesis), an M.S. degree in Chemistry – Plan B (Comprehensive Review), and an M.S. degree in Chemistry with a Biochemistry Option – Plan B (Comprehensive Review).

Comparisons of the Fall 2012 requirements of these degree programs with those of other CSU institutions and one University of California campus are given in Appendix D. Four California State Universities, which award a similar number of undergraduate and M.S. degrees annually, were chosen for comparison with our programs. University of California, Santa Barbara was also chosen for comparison because it has nationally recognized programs in chemistry and biochemistry and, unlike many other larger universities, it also awards a B.S. Biochemistry degree through the chemistry department. The number of Bachelor and M.S. degrees awarded by the comparison universities is shown in the table below.

Number of degrees awarded 2008 – 2009[a]

Institution	Chemistry and Biochemistry Bachelor Degrees	M.S. Degrees
California State University, East Bay	23	13
California State University, Los Angeles	37	17
California State University, Northridge	44	3
California State University, Sacramento	24	4
San Jose State University	31	5
University of California, Santa Barbara	56	8

a. Chemical and Engineering News, August 23, 2010, pp 44-54.

As can be seen from the tables in Appendix D, our degree programs have requirements similar to those of programs at other universities with corresponding degrees. CSU Los Angeles, CSU Northridge, CSU Sacramento, San Jose State, and UC-Santa Barbara all offer B.S. and B.A. degrees in Chemistry and a B.S. degree in Biochemistry. San Jose State University also offers a B.A degree in Chemistry, preparation for teaching. CSU Sacramento offers a B.A. degree in Chemistry, with a Concentration in Biochemistry. CSU Sacramento also offers a B.A. degree in Chemistry with a Concentration in Forensic Science, while we offer a B.S. degree in Chemistry with an Option in Forensic Science (comparisons shown in Appendix D). None of the comparison universities has a B.A. Biochemistry Option in Chemistry Education.

The course requirements for an M.S. degree in chemistry are more variable than those for the B.S or B.A. degrees in order to provide freedom for students to concentrate in the area of greatest interest to them. The number of core and elective course units required in our M.S. degrees is 36 with the remainder of the 45 units coming from completion units such as units for the thesis (Plan A), seminar, and comprehensive review exam and paper (Plan B). As can be seen from Appendix D, these requirements are typical across all of the CSU comparison institutions. Only UC Santa Barbara requires fewer total units for the M.S. degree in Chemistry.

A list of our course offerings is provided in Appendix E. In addition to the core courses of General Chemistry, Organic Chemistry, Quantitative Analysis, Physical Chemistry, Inorganic Chemistry, Biochemistry, Instrumental Analysis, and the associated labs, we also offer a variey of major electives, general education, and service courses. There is a broad range of electives available for students depending on their interests. These include courses in Environmental Chemistry, Bioanalytical and Forensic Instrumentation, Advanced Organic Chemistry, Protein Structure, Nucleic Acid Chemistry, Major Organ Biochemisty, and Protein Chemistry Techniques. Through the graduate level Advanced Topics in Organic, Physical, and Biochemistry courses, cutting

edge topics such as nanotechnology, toxicology, membrane biochemistry, drug design, molecular spectroscopy and bioorganic chemistry have been offered. Different topics are offered every year so that the student can repeat the same course number but cover different subjects. The number and variety of electives and special topics compares well with the offerings of corresponding programs at other universities.

General education offerings include basic chemistry courses such as Introduction to College Chemistry, Basic Chemistry for Health Sciences, and Foundational Chemistry, as well as special topics courses. Popular Topics in Chemistry, which has covered subjects such as energy, has been available as a general education course for non-science majors. The Making of Wine is an upper division general education chemistry course that includes both a lecture and lab component. The number and variety of general education courses that the Department offers also compares well with the course offerings of corresponding departments at other institutions.

2.3. Students , Advising and Retention

Statistics for the Department of Chemistry and Biochemistry on the number of degrees awarded, number of undergraduate and graduate majors, ethnicity of student majors, number of courses and sections, average section size, FTES, FTEF, and SFR for undergraduate and graduate courses, and ethnicity of faculty are displayed in tables in Appendix F. This data was obtained from the CSUEB Office of Planning and Institutional Research and covers data about our program for the last five years.

The FTES for the Chemistry and Biochemistry Department has increased since 2007, from 257.0 in Fall 2007 to 302.2 in Fall 2011. This rise can be attributed to the increases in the number of majors in both our undergraduate and Master's programs and an increase in the number of Health Science and Biological Science students who are also required to take chemistry courses for their major. These gains have more than made up for the decrease in post-baccalaureate students taking chemistry courses for entrance into professional programs in medicine, pharmacy, dentistry, veterinary medicine, etc. In 2009 the university stopped admitting post-baccalaureate students not matriculating in a specific program.

The number of undergraduates majoring in one of the seven degree programs offered by the department has risen markedly, from 149 students in Fall 2007 to 182 in Fall 2011, with increases in both the Biochemistry and Chemistry tracks. This 18 % increase mirrors the increases in enrollment seen in both the College of Science and the University during the same time period. The number of bachelor's degrees conferred by the department has remained fairly constant over the last five years, averaging around 30 per academic year. We anticipate that the number of degrees will increase over the next five years as the increased numbers of undergraduate majors progress towards graduation.

Enrollment in our graduate program has been steady over the last five years, averaging approximately 50 students enrolled during the Fall headcount each year. The number of Masters' degrees conferred has also remained constant. On average, over the last five years, approximately 12 students receive an M.S. degree each year.

Our student profile reflects the diversity of the student body at CSUEB. The majority of our undergraduate majors identify as Asian, although as a percentage this population has shrunk over the past five years (from 43% in 2007 to 28% in 2011 for Chemistry majors and from 49% in 2007 to 39% in 2011 for Biochemistry majors). The percentage of Chemistry majors self-identifying as Hispanic has risen over the past five years, from 11% in 2007 to 24% in 2011, while the number of Black students has risen and fallen with no apparent trend. For Biochemistry majors, the percentage of students identifying as Black or Hispanic has remained fairly constant over the last five years. The percentage of nonresident international students has also remained fairly constant at approximately 6% of both the Chemistry and Biochemistry majors. However, the number of majors listed as unknown has increased, and in Fall 2011 stands at 20% of the Biochemistry majors, making it the second most populous ethnic group. Having such a large student population of unknown makes it difficult to assign too much significance to small increases or decreases in the representation of any ethnicity. Over the last five years, the Chemistry majors have ranged over 48.5-61% female and 39-51.5% male, and the Biochemistry majors have ranged over 50-67% female and 33-50% male.

The largest ethnic group in our Master's program is also Asian, representing about one-third of our students. International student enrollment also makes up a large percentage of our enrollment in the Master's program, averaging about 24% over the last five years. White and unknown make up the next highest groups averaging 12% and 15%, respectively. The number of Black and Hispanic students in our program has remained fairly constant over the past five years, ranging from 1 to 3 for the former and 0 to 3 for the latter with no discernible trend. Over the last five years, the M.S. students have ranged from 42-71% female and 29-58% male, without any trend.

The vast majority of our undergraduate majors in both the Chemistry and Biochemistry programs were full-time students. In the Master's program, slightly over half were full-time students (53.5%). Many of the students pursuing a Master's degree are employed full-time and are thus part-time students. They are typically seeking a degree to give them greater specialized knowledge and the ability to advance in their careers. The data for number of students in our undergraduate degree programs who start as transfer students as opposed to starting as Freshmen was not available from Planning and Institutional Research.

Our total tenured/tenure-track faculty count was seven in Fall 2007 and is currently at seven, whereas our reliance on part-time lecturers varied slightly between 6 and 10. Based on Fall data, over the past five years the ratio of Tenure-Track faculty to Lecturers has varied from a high of 54 to 46 in 2010 to a low of 37 to 63 in 2011.

The tenured/tenure-track faculty has remained composed of six White members and one Asian. The faculty has varied along gender lines, from two males and five females in Fall 2007 to three males and four females in 2011.

Total instructional FTEF numbers for the department have remained fairly constant over the last five years. Overall SFR for the department, on the other hand, has increased over the past five years. The SFR numbers for tenured/tenure-track faculty are typically higher (21.3 to 28.3) than for lecturers (15.1 to 21.2). As is typical, the SFR values for lower division courses are higher than for upper division courses, with a range of 20.4 to 26.8 for the former and 18.4 to 23.6 for the latter over the past five years. Graduate SFR has increased from 5.4 and 6.0 in Fall 2007 and 2008, respectively, to 14.9 in Fall 2011.

The number of course sections offered by our department decreased slightly over the last five years, but the average section size for all courses increased. The increase in section size was the greatest for the graduate classes which averaged 12.3 students in Fall 2007 and increased to an average of 32.4 in Fall 2011. The average section size for upper division classes also increased substantially, from 23.7 in Fall 2011 to 32.4 in Fall 2011. The least increase in average section size was seen in the lower division classes, 29.6 in Fall 2007 and 32.7 in Fall 2011, but these sizes were higher than the average upper division and graduate class sizes to start with. Over the past five years, the majority of the upper division and graduate classes were taught by tenure-track/tenured faculty, and the majority of the lower division classes were taught by lecturers.

The department has been active in participating in CSUEB-sponsored events for recruiting. We routinely set up tables at the Major/Minor Fair and Graduate School Open House. Department faculty meet prospective students and parents at the annual Welcome Day event. Our department-sponsored and American Chemical Society-affiliated Alchemist Club hosts an informational table at the Freshman Advising sessions held in the summer. During the academic year faculty participate in the Major Exploration Workshop sponsored by the General Education department as part of the freshman cluster program.

We also continue to emphasize advising in our department. However, the increase in the number of majors without any increase in the number of tenure track faculty who do advising makes ensuring that every student gets the appropriate guidance very challenging. The department has “road-maps” for each of the degree programs offered at both the undergraduate and graduate level posted on the Department of Chemistry and Biochemistry web site (http://www.sci.csueastbay.edu/chemistry/) (see Appendix G for examples). These help students to determine course requirements and pre-requisites and serve as a guide for long-term planning towards graduation. The department office keeps students up-dated through targeted emails about information on required course offerings and about important dates such as the timing of grad checks. Faculty teaching upper division classes such as organic chemistry, biochemistry and physical chemistry also make periodic announcements in their classes with advising reminders and information.

Students entering the Master's program take a placement exam after admission to the program and get individualized advising from the Graduate Coordinator about what courses they should take. The placement exams are from the ACS Exams Institute, which produces nationally normed standardized exams for most undergraduate chemistry courses. The ACS Exams are created by committees of educators who teach the course for which an exam is intended and several of our faculty have served on these committees. We utilize the ACS standardized exams to determine if our entering M.S. students are at the level to begin graduate work or if there is one or more areas in which they have deficiencies and need remediation.

Work in supervising Plan B (non-thesis) students with the completion of their comprehensive literature review paper is delegated over all full-time tenured/tenure-track faculty members which allows each student individualized attention and help in completing their papers. New timelines with benchmarks and rubrics were developed last year to help the Plan B students move forward on their papers and complete their degrees in a timely fashion. Plan A students also receive advising from the Graduate Coordinator about required coursework, but primarily work closely with their research advisor to complete their theses.

2.4. Faculty

Dr. Tony Masiello joined our department as a new tenure track faculty member in Fall, 2008, after a 2007-08 search. The 2007-2008 search for a biochemist was not successful. Due to budget cuts we were not able to complete a tenure track search in 2008-2009 or 2009-2010. In 2010-2011, another search for a biochemist was conducted and was ultimately not successful. We are currently conducting two searches, one for a biochemist and the other for an analytical/inorganic chemist to join the faculty in the Fall of 2013. Our goal has been to maintain a good balance of expertise in the various disciplines of chemistry among our faculty and to hire individuals with research programs attractive to undergraduate and Master's students. The requests for the two in-progress searches are located in Appendix H.

2.5. Resources

The chemistry department makes use of the IT department for maintenance of faculty and staff computers, the computers in the chemistry computer lab, and the computers used to run chemical instrumentation. The computers in the chemistry computer lab run specialized chemistry course specific software such as Chemdraw, Spartan, the Trinity software IOC (Identification of Organic Compounds) computer program, Gaussian, WinCoot (Crystallographic Object-Oriented Toolkit for Windows), Discovery Studio Visualizer from Accelrys and the MSDS ChemWatch software. The library staff has assisted us with obtaining resources for the Survey of Chemical Literature course such as training licenses for database searching programs Web of

Science and Chem Abstracts On-line. The Chemistry department also relies on Environmental Health and Safety for hazardous waste collection and disposal.

2.6. Units Requirements

Three of the seven baccalaureate degrees offered by the department currently require more than 180 units. These are the B.S. Chemistry degree (182 units), B.S. Chemistry with Option in Forensic Science degree (184 units), and the B.S. Biochemistry degree (183 units). The B.S. Chemistry with Option in Forensic Science degree includes special requirements from Criminal Justice and Biological Science. The B.S. Biochemistry degree program also requires courses in Biological Sciences that contribute to the high number of units. We have taken a close look at these requirements and developed a plan to reduce the number of units required to 180 without diminishing the quality of the programs (see curriculum changes in Plan).

2.7. Transfer Model Curriculum

A chemistry Transfer Model Curriculum (TMC) has been developed for the Associate in Science for Transfer (AS-T) degree program soon to be offered by the California Community Colleges (CCC), as mandated by Senate Bill 1440 (the Student Transfer Achievement Reform bill). The chemistry TMC was drafted in Fall 2010 and Winter 2011 by Discipline Input Groups (DIG) consisting of chemistry faculty from the CSU and the CCC representing northern and southern California. It has not yet been approved by the CSU Chancellor's Office but is currently under review by the chemistry Faculty Discipline Review Groups.

The Faculty Discipline Review Groups (FDRG) consist of faculty from the CSU, the CCC and sometimes also from the University of California. Their role is to review the TMC for the relevant discipline, reconcile input or criticism from faculty and actively work to finalize the TMC. The chemistry FDRGs may be close to finalizing the chemistry Transfer Model Curriculum (Postma, Jim. "Report on SB 1440," Faculty to Faculty, Issue 1, November 2012). When the chemistry TMC is approved we will review it and our curricula with a view toward making sure students transferring with the AS-T degree can complete a Bachelor's degree in chemistry in an additional 90 units. The FDRGs also develop, review and revise course descriptors. New descriptors for nine chemistry courses or course series, including General Chemistry and Organic Chemistry, have been vetted by statewide chemistry faculty and finalized by the chemistry FDRGs.

3. Five Year Plan

3.1. Curriculum

a) The undergraduate majors program

Recent additions of the Chemistry Education degree options (B.A. Chemistry, Option in Chemistry Education and B.A. Biochemistry, Option in Chemistry Education) have broadened and enhanced our curriculum. We now have seven undergraduate degree programs that students can choose from depending on their future career goals. We will allow the new degrees time to become established and do not plan to add any new options at this time. The results of assessment efforts indicate that the majority of our majors are successfully reaching the student learning outcomes in both the chemistry and biochemistry areas. Over the next five years, we hope to implement curricular improvements that will align with the university mission and goals, keep our programs and course content up-to-date, and help our students maintain a high level of achievement.

As described in the Self Study, the number of Chemistry and Biochemistry majors has been rising steadily during the last five years. The department FTES has also risen significantly, and part of the increase is due to growth students from other departments who take out classes, most notably from students majoring in Biological Science or Nursing and Health Science. In proposing changes to our curriculum, we are mindful of the potential impact not only on our majors, but also on the other science students who take our courses.

Modify three of the degree programs to meet the CSU-wide goal of 180 maximum total units. We think the Chemistry and Biochemistry degree programs are generally well designed and include an appropriate spectrum of requirements and electives. For three of the programs, the total number of required units is above 180. These are the B.S. Chemistry, B.S. Chemistry-Option in Forensic Science, and B.S. Biochemistry degrees. In accordance with current CSU policy, we will reduce the major requirements for these degrees to bring the total required units to 180. The B.S. Chemistry degree is accredited by the American Chemical Society and has required a large number of units (182-183) to meet the accreditation requirements and provide breadth in the chemistry sub-disciplines. We will decrease the number of required electives in this program from the current 11-12 to 8-9. This will not impact the accreditation requirements and will bring the maximum required for the major to 180 units.

The B.S. Chemistry-Option in Forensic Science degree spans the disciplines of chemistry, biological science and criminal justice. Each discipline is covered in some depth in the program, thus the high number of units (184). We will eliminate the requirement for Statistical Methods in Biology. A course in statistics is not a program requirement of our B.S. Chemistry degree, nor is it a requirement in any degree in the comparison programs (Appendix D).

To lower the total units for the B.S. Biochemistry degree program from 183 to 179 we will drop the Introduction to Computers requirement and rely on high school courses or independent student learning for computer literacy. The B.S. Biochemistry major necessarily has a high unit count because in addition to the basic chemistry curriculum it requires a year of biological science and the biochemistry courses. We have already incorporated sessions on the use of Excel for data analysis into several of the required laboratory courses, and this should partially compensate for elimination of the Introduction to Computers course. Instruction on the use of specialized computer programs for chemical and biochemical analysis is also provided in several required and elective courses.

Increase the number of undergraduate biochemistry and chemistry courses taught by tenured or tenure track faculty; encourage new faculty to modernize course content and employ innovative teaching techniques. At present about 44% of the undergraduate course sections offered by the department are taught by tenured or tenure track faculty, which is below the CSU system goal of 75%. If both of the tenure track hires we are conducting during 2012-13 are successful, we should be able to bring the percentages of courses taught by regular faculty up to about 57%. Over the next five years it will be our goal to continue to submit applications for tenure track faculty positions to reverse the trend of using high turnover part-time lecturers and teaching associates for so many of our classes. We will encourage new faculty to update course content that has become stagnant due to the use of a series of temporary instructors over a fairly lengthy period.

One of the more serious curricular issues facing the department is a six year history of upper division biochemistry courses having been taught by part-time lecturers, despite the fact that more than half of the department majors earn degrees in biochemistry. The death of one of our biochemists in 2006 was followed by years of budget issues and a failed search, and he was not replaced. Fortunately, that situation will be rectified with the hiring of a tenure track biochemist for the 2013-14 academic year.

The new biochemist will teach majors-level courses and upper division service classes currently assigned to part-time lecturers. We will encourage a careful survey of the course contents and implementation of new emphasis on areas where recent developments have occurred. The hiring of the new biochemist for 2013-14 will certainly help improve the curriculum, but we will still not have sufficient number of regular faculty to teach all the upper division biochemistry courses. We will likely need to hire another biochemist sometime in the future.

There is also a shortage of faculty to teach General Chemistry, Quantitative Analysis, Inorganic and Organic Chemistry. Moreover, all of the Pre-Nursing and other non-majors chemistry courses except the newly introduced Foundational Chemistry lecture class are being taught by part-time lecturers. These problems are being partially addressed with a 2012-13 search for a tenure track Analytical or Inorganic Chemist. The issue of Quantitative Analysis being taught by part-time lecturers is especially troubling.

This course introduces the use of large instruments into the curriculum and is required for all of our B.S. degree options and the Minor in Chemistry. A new faculty member is needed to help update the department instrumentation and to teach Quantitative Analysis. Hopefully that will happen in the current search.

We will continue to apply for new tenure track positions over the next five years in an effort to bring the percentage of courses taught by tenured or tenure track faculty up to 75%. We need additional faculty in all the sub-disciplines of Chemistry, with the most urgent needs in Organic Chemistry and Analytical or Inorganic, depending on the outcome of the 2012-13 search. All new faculty will be asked to modernize the majors-level courses they are assigned and think creatively about how they approach the non-majors classes they teach. They will be encouraged to take advantage of workshops on teaching strategies offered by our Faculty Development Center and other specialized workshops such as those offered by the American Society for Biochemistry and Molecular Biology, the CSU Program for Research and Biotechnology and the American Chemical Society.

Teach inorganic chemistry on a yearly basis. Currently the Inorganic Chemistry series (CHEM 4161, 4162, 4180) is taught in alternate years due to earlier low enrollments. The inorganic classes are required for the B.S. Chemistry major and are used to satisfy the Foundational and In-Depth coursework requirements for ACS accreditation. The recent increase in enrollment in the B.S. chemistry degree program and the relatively high number of students registering for the inorganic classes now warrant them being taught on a yearly basis. The hiring of a new tenure track faculty member (during 2012-13) with expertise in inorganic or analytical chemistry may facilitate this goal.

Use the "Instructional Activities in Chemistry" course to develop a service learning component for additional degree programs. As described above, we recently added Options in Chemistry Education to our B.A. Chemistry and B.A. Biochemistry degree programs. A new two unit course designed to provide guidance in teaching chemistry was developed specifically for the new degree programs. The new course, entitled "Instructional Activities in Chemistry" (CHEM 4400), has a normal lecture component but also a service learning component where students are expected to involve themselves in chemistry teaching activities such as tutoring, working with high school and middle school teachers as aides, providing help with science projects, etc.

To bring the opportunity to gain credit for this type of service learning to a wider number of our majors, we plan to add the CHEM 4400 course as an elective to the B.S. Chemistry, B.A. Chemistry and B.A. Biochemistry degree programs. Although students in these majors may not plan to become high school teachers, they will most likely find themselves in situations during their careers where teaching skills are required. As teachers ourselves, we know the best way to really learn a concept is to be required to explain it to someone else. Moreover, many of our students are interested in outreach activities that will provide experience in a workplace environment, broaden their knowledge of the opportunities available to them, and enhance their resumes.

There are a number of ways our students can connect with classroom teachers for service learning assignments. For example, students can be placed as teacher aides in middle and high school science classrooms through the CSUEB Affiliates Program funded by the Chancellor's Office Math and Science Teacher Initiative (MSTI) program. This program involves over 30 high school and middle school science teachers. Several College of Science faculty members, including Danika LeDuc of our department, have participated in the CSUEB portion of the program, which is co-directed by Jason Singley (Physics), Kathy Hann (Math and Computer Science), and Jeanette Bicais (Teacher Education).

The CHEM 4400 elective will be added to the three majors, with the caveat that no more than a specific number of units can be used for CHEM 4400, CHEM 4900 (Independent Study), CHEM 4810 (Undergraduate Research) and CHEM 4811 ((Honors Thesis) combined. The B.S. Chemistry degree currently allows four units for CHEM 4900, 4810 and 4811. The CHEM 4400 course is just two units and would provide another career-enriching opportunity in addition to research for the students in the ACS-accredited B.S. Chemistry degree. (Our program does not require undergraduate research but, in accordance with the ACS guidelines, we strongly encourage it and the majority of the B.S. Chemistry majors do participate in a research project under the supervision of one of the department faculty.) For the B.A. Chemistry and B.A. Biochemistry degrees, two units will be allowed for the combined electives of CHEM 4400, CHEM 4900 and CHEM 4810.

Continue to upgrade laboratory curriculum and instrumentation. Over the last few years, we have dramatically improved our laboratory curricula, especially in the biochemistry and general chemistry areas. We plan to continue our efforts in this area. After a successful completion to the on-going search for an Analytical / Inorganic chemistry faculty member, we hope to make strides in improvements to the Quantitative Analysis laboratory curriculum over the next five years.

In an on-going effort to keep our laboratory curriculum current, new experiments incorporating new instruments and techniques are planned for existing laboratory courses. A new experiment is planned by Dr. Chul Kim to introduce the new spectrofluorometer into the Instrumental Analysis lab. Dr. Sommerhalter plans to make changes to the General Biochemistry lab to integrate individual experiments into one larger project driven by a concrete question. For example, students may characterize the detoxification enzyme glutathione-S-transferase from fish or clam in dependence of species or location (collection site) which can serve as a biomarker to monitor aquatic pollution.

We also plan to continue to update the instrumentation used in the teaching laboratories and in research. New gas chromatographs will be purchased for the organic labs to replace old gas chromatographs attached to integrators. The integrators are no longer functioning and are no longer sold or supported by the manufacturer. Because there is no other substitute for them, we will upgrade the entire system. Dr. Kotchevar will spearhead this effort. We also plan to purchase Biotage Initiator microwave

synthesizers for each of the three organic teaching labs. Dr. Groziak will spearhead this effort and design the experiments which incorporate the use of the microwaves into the organic laboratory curriculum. Dr. McPartland will lead the effort to obtain a new HPLC with fluorescence detection for use in the Biochemistry laboratory curriculum, as well as for research. This HPLC will replace an older, non-operational one and will add the ability to use fluorescence to detect compounds at much lower concentrations.

Vital to the use of state-of-the-art instrumentation in the teaching laboratories is the continued maintenance of the instruments. Service contracts will continue to be requested to support the NMR, HPLC, and GC-Mass Spectrometer. As the warranties on new instruments expire, we plan to request funds to purchase service contracts to cover their maintenance and repair.

To make the areas around the chemistry department more interesting and more visually exciting, we also plan to enhance and update the display cases around the Department. Dr. Groziak will lead this renovation effort. In addition, we will replace the periodic tables in several labs.

b) The General Education (GE) Curriculum

Revise CHEM 1100, Introductory Chemistry. CHEM 1100 is currently a requirement of the liberal studies major. However the course was initially designed as a pre-chemistry course for majors and is still taught with the goals of preparing students for the more rigorous general chemistry series by emphasizing math skills. To better serve the student population who are actually taking the course, we plan to make changes to the course. This will reflect a relatively minor change in course content, with increased emphasis on the practices of science (observations, predicting, analyzing) and engineering (real-world applications, design, and optimization) and concepts that cut across different science disciplines. Additionally, the labs and lectures will be revised to make them more student-centered, reflecting research-based improvements in pedagogical strategies. Dr. LeDuc will take charge of rewriting the labs of the class and making group worksheets and exercises for lectures to make the content align with the Next Generation Science Standards which will be adopted by the state of California for K-12 education in Fall 2013. Liberal Studies majors on the Teacher Preparation Pathway will benefit greatly from both types of changes as they will be better equipped to teach in the K-8 classroom of the future.

c) Concord Campus

We currently offer the pre-nursing chemistry series, Basic Chemistry I and II (CHEM 1601-02), on the Concord campus once per year and plan to continue to do so.

d) Master's Degree Program

The average number of students enrolled per section in the graduate classes has increased over the past five years. The average graduate class size has also increased and

is becoming too large for instructors to maintain effective teaching at the graduate level. In order to meet the needs of the students, we plan to offer more sections of some of the required courses. Seminar is a one unit course that students are required to take three times. Because students are expected to give seminars on current chemical literature in this class, the cap on the course is twenty. We plan to offer more sections of this course throughout the year to ensure that every graduate student is able to enroll.

With the increasing enrollment, there has also come a higher demand for graduate level classes. We plan to offer Advanced Topics in Biochemistry and Advanced Topics in Organic Chemistry more than once per year. Students are allowed to take an Advanced Topics course more than once when the topic has varied, so offering the course more frequently with different topics will give the students more 6000-level courses to choose from. We also plan to introduce a new graduate level course in Spectroscopy.

e) Outcomes Assessment Plan

We have come to realize that our Outcomes Assessment Plan was too ambitious and broad in scope. Rather than trying to assess every course, we plan to focus on key classes which demonstrate the overall learning outcomes of the program. In consultation with the faculty who teach the courses in the various disciplines, we will devise a means of assessment for each of the key courses that can be compared year to year consistently. In addition, the University is undergoing a program prioritization program. We plan to modify our assessment plan so the assessment of our program learning outcomes is in line with the goals of program prioritization. We will also look to the ACS Committee on Professional Training (CPT) guidelines for recommendations on the assessment of our courses. The CPT conducts the approval procedure for bachelor's degree programs in chemistry, and publishes guidelines on conceptual and practical topics for Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, and Physical Chemistry. The textbooks we choose and the syllabi we design for our courses follow these guidelines closely, to see to it that our students are provided with a scientifically-current didactic experience.

3.2. Students

a) Enrollment Growth, Outreach and Program Resources

The number of undergraduates majoring in chemistry or biochemistry rose approximately 18% from Fall 2007 to Fall 2011. As this increase follows the trend seen at the University level, we expect that if the University plans to continue to increase enrollment, the number of Chemistry and Biochemistry majors will also increase. Because chemistry and biochemistry are laboratory sciences, most of our courses are designed with an accompanying lab component. Space in the lab is often the limiting factor for offering more sections or larger sized classes. After ten years of enrollment growth we are approaching a plateau in terms of ability to accommodate an increase in the number of student majors (and students from other majors taking chemistry courses)

unless additional resources become available. The classroom laboratories are full essentially all the daytime hours, and up to three student groups are sharing the same equipment drawers where feasible.

If we continue to see increases in the number of students taking chemistry courses over the next five years, it will be necessary to schedule evening labs and remodel the current laboratories to increase the numbers of lockers. Evening laboratories would require additional technical staff to prepare course materials and be on hand during the lab sessions. More full time tenured and tenure-track faculty would also be needed to advise and serve as research mentors if the number of majors increases.

Although we won't rule out adding new programs over the next five years, since it's hard to predict the talents of new faculty who will be hired, we hope to reach new student populations mostly by working on the programs we have recently developed in Chemistry Education. As described below, a large demand for teachers is expected in the Bay Area over the next five years, and science teachers will be especially needed. We hope to identify and encourage students with an interest in teaching to major in chemistry or biochemistry via the B.A. degrees with Option in Chemistry Education. We also hope these degrees will attract more science majors to the teaching profession, and we will make students aware in advising sessions that the B.A. Chemistry and B.A. Biochemistry, Option in Chemistry Education degrees prepare graduates to directly enter a credentialing program.

The recently established Certificate in Foundational Science provides an outreach vehicle to credentialed teachers who wish to be certified to teach middle school or K-5 science. We hope to continue to serve these teachers. One of the chemistry courses developed for this program (CHEM 3011) was developed by Dr. Danika LeDuc as an online offering and was recently approved as an upper division general education elective. Initial interest in this course by CSUEB students has been strong. As new faculty are hired over the next several years we hope to offer CHEM 3011 more often, thereby reaching a larger group of students seeking to satisfy the upper division GE science requirement.

b) Changing Career Opportunities for Students

At the time of our last Five Year Program Review (2007-2008), the Bay Area economy was doing well and the outlook for our students to find jobs in industry was bright. As the economic crisis materialized in late 2008 and has continued over the last few years, the number of jobs available for the chemistry and biochemistry graduates decreased. Most of our recent graduates have found work, but often it took a long time. The US Bureau of Labor Statistics (BLS) reported the unemployment rate among chemists and material scientists was 6.1% in 2011 compared to an overall unemployment rate of 8.8% (C & E News, March 26, 2013). The local chemistry industry appears to have been affected more severely than the industries employing biochemists. Predictions from the Bureau of Labor Statistics for the East Bay Area show an expected growth in industry jobs for biochemists and biophysicists between 2008 and 2018, with 361 new

and replacement positions predicted, whereas a small decrease in new jobs for chemists (19) is predicted. Fortunately, the decrease is expected to be offset by the 330 replacement jobs for chemists that will become available during 2008-2018.

There should be jobs available in Bay Area industry for our graduates over the next five years, albeit not as accessible as in earlier years. To help them be competitive, we need to provide the best training possible. We need to make sure our students achieve the learning outcomes we have developed. Additionally, we need to continue to improve the department instrumentation so students can train on modern equipment representative of what they will find in industry. As documented above, we have made good progress over the last two years in improving our instrumentation through the university Instruction and Research Equipment Program and hope to continue to modernize over the next five years. Strong workplace performances by our graduates will help to build the local reputation of CSU East Bay, and this, in turn, will help newer graduates to get jobs.

Many of our biochemistry majors are planning advanced study in a health profession. The B.S. Biochemistry curriculum includes most of the courses required for admission to programs in medicine, dentistry, pharmacy and optometry, and is also good preparation for other health fields, such as physical therapy and physician assistant. The BLS predicts new and replacement jobs in the East Bay for all of these fields over the next five years. We hope to do our part to prepare students for the health professional schools by maintaining a high quality of instruction and keeping our course content current as new discoveries are made in the biomedical area.

The Bureau of Labor Statistics predicts many new and replacement jobs in the teaching profession for the East Bay Area over the 2008-2018 period. For example, the number of jobs for secondary school teachers is predicted to be more than three times the number for chemists and biochemists combined. Of course, only some of these jobs will be for science teachers but still the market will be strong. We hope to help fill the need for quality secondary school science teachers by promoting the Chemistry Education degree options we have developed for our chemistry and biochemistry majors. The degrees have the advantages of training students both as chemists/biochemists and also preparing them for earning a teaching credential. Thus students majoring in these degrees will have the opportunity to work in industry or go into a health profession in addition to preparing for a career in teaching.

The B.S. Chemistry and B.S. Biochemistry degrees also continue to provide good preparation for graduate study, and we anticipate that some of our students will go on to Master's or Ph.D. programs. We have a good success rate for admission of our graduates to both types of graduate programs. These individuals will go on to work at high levels in industry or obtain academic positions.

The campus Academic Advising and Career Education (AACE) center is a resource for students seeking to apply for summer internships or part-time employment, and for those nearing graduation and planning to seek full time employment. The center offers a variety of counseling services for job seekers, including help in preparing

resumes and establishing possible job contacts. It also provides links to internship sites and job listings of various kinds and holds three job fairs a year. Companies that hire chemistry and biochemistry graduates are invited to participate in the job fairs and usually do. To make sure students are aware of the employment services offered by the AACE center, the department office staff and faculty will make a special effort to inform students of this resource as they come to the department for major advising.

Employers often contact the department when seeking student interns or entry level employees. The faculty inform students by making announcements in their classes and the Chair sends an e-mail to the majors through Blackboard.

c) Advising and Retention

Advising and retention are both high priorities for our department. Our full-time faculty split advising duties at the undergraduate level by each taking a portion of the alphabet. This gives our students a consistent "go-to person" throughout their time in the department, regardless of the degree option with which they eventually graduate. At the graduate level, we have a dedicated graduate coordinator who administers placement exams and meets with students regularly to ensure that they make consistent progress towards graduation. Additionally, all graduate students have an individual faculty advisor. Plan A students conduct research in a faculty member's lab and get extensive mentoring from their faculty mentor, not only with respect to their research project, but also regarding course selection and career goals. This mentoring relationship is also an important aspect of advising and retention for our undergraduate students who conduct research. Additionally, Plan B MS students are assigned a faculty member who guides them toward the completion of their final literature review paper. Increasing our number of faculty will lead to greater research opportunities for our undergraduate and graduate students, allowing for closer, one-on-one mentorship of a greater proportion of our students.

We always seek new ways to improve the effectiveness of our retention and advising activities. At present, we are anticipating the opening of the new College of Science Student Support Center and hope to work closely with its personnel once it is established. The center will provide a dedicated office just for student advising in the College and should provide a conduit for undergraduates to seek out major advising early in their college careers when it is most effective. We expect the Center personnel to help with general advising but also to direct students to our faculty advisors when appropriate, e.g. when students are uncertain about the appropriate major for their life goals or about the time frame for the courses they need to take or just need advice from a chemist or biochemist. We are hopeful that the increased emphasis on advising will help our majors to navigate their programs more efficiently and provide them with the motivation to complete their chosen majors in a timely fashion.

d) Chemistry Club

The Chemistry and Biochemistry Department supports a student Chemistry Club (called Alchemist's Club) which is a student affiliate group of the American Chemical Society. The club's mission is service. This can take the form of service to the department, the university or the community at large. One of the department faculty members serves as Alchemist's Club advisor each year. Chemistry and biochemistry majors are asked to join and student officers are elected.

The vitality of the club varies from year to year and depends primarily on the enthusiasm of the students involved. In some years the club members have become involved in activities such as raising money for the department, demonstrating science experiments in middle school classrooms, helping to rebuild homes through the Habitat for Humanity program, and serving as volunteers to assist in the chemistry magic show at the biannual College Science Festival. In other years the Alchemist's Club has not been very aggressive and few activities have been scheduled. When this happens the students lose an opportunity to develop a sense of how a citizen who also happens to be a scientist can serve his or her community.

The department plans to work to motivate chemistry and biochemistry students to join the Alchemist's Club and keep it active. We will contact all student majors each year to inform them of the club and ask them to participate. Then we will encourage the club members to develop service projects. One way of helping to motivate club members might be to suggest projects for them. Some things that come to mind are judging local high school and middle school science fairs, organizing a forum for representatives from the Academic Advising and Career Education center to speak to undergraduates about job opportunities, volunteering to host exhibits for the Fall 2013 Science Festival and providing chemistry tutoring for younger students.

Although e-tutoring in chemistry is available to all CSU East Bay students through the Student Center for Academic Advising (SCAA), additional tutoring provided by Alchemist's club members would be welcome. Students matriculating in several different majors are required to take lower division chemistry courses and there is a continuing demand for one on one tutoring in chemistry.

3.3. Faculty

As the number of undergraduate majors in the department has grown and with the large number graduate students, the demand for research mentors is far greater than the current faculty can supply. In addition, the department is now relying on part-time instructors to teach the majority of sections offered. After the current search for two tenure track faculty members in the areas of biochemistry and analytical / inorganic chemistry are complete, we anticipate the need to hire in the areas of organic chemistry and analytical or inorganic, depending on the outcome of the current search, over the next five years. The new faculty hires will need research lab and office space.

Mentorship of undergraduate and Master's level research projects is an important function of the full-time tenured and tenure track faculty. However, directing student research requires a large time commitment from faculty both to train the students in the experimental methods and to supervise them in potentially hazardous laboratory situations. Previously, two supervisory units per year were granted by the College of Science to faculty who supervised research students. However, three years ago, these supervisory units were taken away. In order for our majors to be competitive for entry into the job market or graduate and professional schools, they need to have the opportunity to demonstrate independent research skills. The only way to do that is for the faculty to be granted time to supervise them.

Finally, faculty members need to have private offices. Due to the experimental nature of our research and the need to be on campus to supervise students in research laboratories, the Chemistry Department faculty members are generally on campus all day, every day. It is extremely difficult to work effectively in shared offices when the other faculty member is holding office hours, advising, or meeting with research students. Yet, it is impossible to work elsewhere and still be available to students engaged in research.

3.4. Other Resources

One of the most pressing needs is to replace one of our stockroom prep technicians who sadly died this past summer. The stockroom prep technicians play a very important role in sustaining our laboratory classes. They are responsible for preparing and dispensing the chemicals and solutions required for each lab, ordering replacement chemicals, and removing and disposing of the chemical waste. In addition, the stockroom prep technicians set up and calibrate the equipment used in the teaching labs. We also desperately need to replace the stockroom manager who retired at the end of 2009. In addition to supervising the stockroom staff, he played a critical role in equipment maintenance and instrument training. We need one person to coordinate the care of laboratory equipment used in common; to initiate and monitor repairs and preventive maintenance, to develop basic protocols, and to support faculty in the development and execution of new classroom experiments using the instruments.

The department also needs more space for instrumentation. Many of the shared instruments are in the backs of teaching laboratories which limits their accessibility for research to times when classes are not in session. With the dramatic increase in the number of laboratory sections offered over the last five years, there is very little time except at night and on the weekends when classes are not in session. This drastically restricts the utility of these instruments. It also impacts the ability to use the instruments in more than one class as students from the other course or section would have to disrupt the first in order to have access to the instrument. Our plans to acquire new instruments are severely limited by the lack of space to house them.

4. External Reviewer's Report

California State University, East Bay
Department of Chemistry
Final Report for Visitation on 2/15/13
Bradley M. Stone, Ph.D., External Reviewer
Department of Chemistry, San Jose State University

Outline

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Preface

I was invited by Prof. Ann McPartland, Chair of the Department of Chemistry & Biochemistry to perform the review of the Department as part of the Program Planning process. Despite being on sabbatical leave this semester, I was delighted to agree to participate as the Department's External Reviewer. The review took place on Friday, February 15, 2013. During the review, I met with Dean Michael Leung of the College of Science, Chair Ann McPartland, (nearly) all tenure-track faculty members in the Department of Chemistry & Biochemistry, two of the part-time faculty members, all Departmental staff (administrative and technical), and 3 Chemistry majors. Prior to conducting the review, I was provided with copies of the Self Study. The Self Study included the following information as part of the review process:

- The Five Year Review and Plan, 2012.
- A copy of the Faculty Participation in the Tenure-Track Allocation Process for CSUEB.

- Tables of Academic Performance Review statistics for the 2008-2012 time period under review.
- Final Annual Reports for each year during the review period.
- A copy of the SLO Assessment Rubric.
- A copy of the University Mission Statement.
- Curriculum Vitae for all regular (tenure-track) faculty members.
- Roadmaps for each degree program in the Department.
- Syllabi for all courses offered within the Department.

During the day long review visit, I received a thorough tour of the departmental facilities. Between my readings of the Self-Study, including the above materials; the day long visit of the Department during the review; as well as prior knowledge of the Department from regular interaction with the present Department Chair (particularly at the Annual CSU Chemistry Chairs meetings that both of us regularly attended over the several years that we overlapped as department chairs), I was able to achieve a thorough and comprehensive picture of the Department – and to be able identify its strengths and weaknesses.

I believe that my role is to facilitate self-reflection, as to who you are as a Department, as well as who you would like to be. Hopefully, through the eyes of an outsider, my comments and observations can be looked at objectively and will be useful for your future development. My role should be thought of more as consultants rather than critics – and I hope that my recommendations are taken in that vein.

I would like to thank everyone involved in this process that I met with for their warm hospitality, their honesty and candor (which is vitally important for this process to be efficacious) and for their dedication to the mission of the Department and California State University, East Bay (CSUEB).

Departmental Overview.

The Department is currently staffed by 7 tenured/tenure-track (regular) faculty members, 12 lecturers (part-time instructors), several T.A.s, and 3.5 FTE (full-time equivalent) staff positions. There are currently 2 searches underway for tenure-track positions. In 2011, the percentage of tenured/tenure-track faculty to full-time equivalent faculty was 46%, and this has not significantly changed since then. Adding two new tenure-track positions (if the searches are successful) will help increase this ratio, but it will still be far from the 80% ideal for which the CSU once strived (the Self Study quotes this figure to be 75%, but I have always understood it to be 80%). For a Department of this size, this would seem fairly typical within the CSU at one of our larger campuses, given the current economic climate – although I note here that this is on the low end of the number of tenure-track faculty necessary to run a department of this size. The Department serves the needs of a diverse population of students – both majors and non-majors – that require chemistry as a part of their curriculum (biology, nursing, engineering, etc.). Many of these students go on to graduate or professional schools; others go directly into industry

following their degrees. The majority of professors in the Department presently have active, healthy research programs that involve students. These research programs provide the basis for M.S. Chemistry student theses, as well as providing research opportunities for undergraduate students.

Overall, in my opinion, the Department is providing an outstanding educational environment for its students, despite the typical lack of resources, funding, research space and support for faculty that is endemic to the CSU. I cannot stress enough how impressed I was with the members of the Department: you have an excellent coterie of young faculty to serve as the core of your Department for years to come, and a professional, dedicated staff who also believe in the Department's and University's mission. I think that your Department is closely comparable, and of similar high quality, to several other well respected Departments within the CSU, both at similar size institutions (e.g. Sonoma State) and at even larger CSU campuses (e.g. Sacramento, San Francisco, San Jose, Fresno).

Current Curriculum

Bachelor's Degrees

In this section, I address the current chemistry degree programs offered at CSUEB, the appropriateness of these programs given the career paths that your graduates take.

The Department currently offers seven baccalaureate degrees, the B.S. Chemistry (ACS Certified), B.S. Chemistry with Option in Forensic Science, B.S. Biochemistry, B.A. Chemistry, B.A. Chemistry with Option in Chemical Education, B.A. Biochemistry, and B.A. Biochemistry with Option in Chemical Education.

The **B.S. Chemistry** degree is certified by the American Chemical Society (ACS) – this is the rigorous chemistry degree that is equivalent to B.S. Chemistry degrees given by colleges and universities around the country. The ACS maintains rigid standards that departments are required to fulfill, such as the inclusion of particular courses in the degree program, the submission of annual reports, the submission of an extensive 5-year report including external review, requirements of contact hour limits by part-time faculty members, etc. The Department is serving the students well with this degree, and is encouraged to maintain their certification with the ACS. Many universities and companies recognize the ACS certified degree, so it is an advantage for your graduates to be able to put this on their resume. This is the degree that students should seek if they plan to go on to an M.S. or Ph.D. program, or work in industry as a chemist.

The **B.S. Chemistry with Option in Forensics** is a degree track specifically for those students who are keen to follow a career as a forensics chemist or criminalist. Although students could certainly pursue a career path in Forensics without this specific degree (e.g. they could obtain a "straight" B.S. Chemistry degree, and get forensics specialization later, either in graduate school or on the job training; this degree provides a strong chemistry background along with some forensics training, and therefore provides a

solid degree for this career path, along with the "marketability" of the degree (i.e. students may be specifically attracted to CSUEB because you have this degree program). The Department offers the **B.S. Biochemistry** degree. The B.S. Biochemistry degree is a more rigorous degree track for the pre-health profession students, pre-pharmacy students, etc. than the B.A. degree that many pre-health students would otherwise follow. Given the growth of the biopharmaceutical industry, this degree makes sense, and is a popular choice by majors within the Department. This degree also presents an alternative for those students interested in pursuing a graduate degree in areas of chemistry that are more biologically oriented. The idea behind giving students this option, rather than having most pre-health and pre-pharmacy students take the B.A. Chemistry program, is that students would have a more rigorous B.S. degree to fall back upon, if their plans to enter medical school, dental school, pharmacy school, etc. do not pan out. This degree then gives students the solid background necessary to potentially be successful in the industrial job market as a chemist or biochemist.

In addition to the B.S. Chemistry degrees described above, the Department offers 4 different versions of the B.A. Chemistry degree. The **B.A. Chemistry** degree is a less rigorous chemistry curriculum, and is a degree currently sought by many students who are pursuing the health professions (medical school, veterinary school, dental school, pharmacy school, etc.) It is not clear from the tables provided in the Self Study as to the number of B.A. Chemistry majors there have been in the last 5 years (B.A. and B.S. majors are counted and reported together as either Chemistry or Biochemistry).

During a recent review that I was asked to perform at another CSU (with a larger student population and larger Department than at CSUEB), the external review team was asked by the Provost and Associate Provost to evaluate whether the Department really needed 3 baccalaureate degrees. At CSUEB, the Department is managing 7 baccalaureate degree programs. In fact, at a time when other CSU campuses have been paring down the number of degree programs, it seems as though the Department of Chemistry and Biochemistry at CSUEB has added degrees. This is a lot for a Department of 7 regular faculty members to handle, and I must question whether all these degrees are really necessary – or if the program can be condensed into a more streamlined version.

Master's Degrees

The Department offers two M.S. degrees, an **M.S. Chemistry** and an **M.S. Chemistry with Option in Biochemistry.** Both of these degrees are offered with two separate course requirements, referred to as Plan A and Plan B. Those students wishing to follow a research-intensive Master's degree with a thesis follow Plan A. The Plan B track is a non-thesis requirement degree.

Department Chair

The Chair of the Department of Chemistry is a 0.6 time appointment. This means that, in addition to the 0.2 that all regular faculty have assigned to them for service work (e.g. committees), the department chair must also have an additional 0.2 of his/her teaching

load assigned to some other task (e.g. teaching a 3-unit lecture course) to account for a full 1.0 assignment. This represents a considerable workload for the chair (one can certainly argue that being department chair in a department of this size is at least a full-time job in and of itself), however, this is in keeping with the fraction of administrative time given to department chairs at other CSUs (e.g. the Department of Chemistry Chair is a 0.6 assignment also at San Jose State University as well).

The current Department Chair of Chemistry, Prof. Ann McPartland, has been in this position for several years. She has nurtured a culture of scholarship, excellence in teaching, and collegiality. She recognizes the importance of scholarship, and has striven to hire new faculty members who are strong researchers, while simultaneously keeping in mind our mission in the CSU to maintain excellence in teaching.

I saw and heard ample evidence that Prof. McPartland is doing an outstanding job in running the Department. I came to this conclusion following interviewing most of the regular faculty, some part-time instructors, all of the staff, as well as some students in the Department. Overall, the Department seems to be extremely pleased about the direction of her leadership. In fact, it is rather remarkable that everyone whom I interviewed had only positive things to say regarding the running of the Department by Prof. McPartland. Examples of this are the following comments that faculty, staff and students made: "calm", "understanding", "kind", "listens", "logical – no ridiculous ideas", "handles every kind of situation", "very good with students, almost to a fault (spends a lot of time with them)", "Ann has done a heck of a job, given the constraints", "can't say enough about Ann as Chair, personally and professionally", "great leader" and "very caring". She appears to have strong support of the faculty, and the staff respects the fact that she always makes time for them, despite how busy she might be. Chair McPartland also appears to have good communication with the other Chairs within the College, and the upper administration as well (Dean Michael Leung, Provost Hoopis, etc.).

Full Time Faculty (Professors)

I had the opportunity to meet with all but one of the regular faculty members (McPartland, Kotchevar, Groziak, Kim, Masiello, LeDuc; Sommerhalter was off campus that day). I met with each regular faculty member on a one-on-one basis. During the course of these meetings, I was shown individual research labs, teaching labs, instrumentation, etc. – in other words, I was given a tour of the departmental facilities during the course of these meetings. The faculty appears to be a very cohesive group, with everyone "on the same page" in terms of the Department's mission. What became readily apparent to me is all of the activities that the faculty is involved in: teaching heavy loads, advising, performing original research with undergraduate and graduate students, committee work, assessment, forging relationships with the community and local industry, etc. I learned that the faculty has mentored of 68 undergraduate research students, and 48 Master's students projects during the time period under review. Overall, I am very impressed with the incredible energy of the faculty and its dedication to the students at CSU East Bay.

Part Time Faculty (Lecturers)

I was given the opportunity in a separate session to meet with part-time faculty members. Two lecturers met with me, Dr. Dale Johnson and Dr. Richard Fronko. Both Dr. Johnson and Dr. Fronko specifically came to campus on days that they were not teaching or required to be on campus, specifically to meet with me – with which I was very impressed. Both spoke of their love for their jobs and the enjoyment they each receive teaching the students at CSUEB. Both also have positions elsewhere; Dr. Johnson has a full-time post at Life Chiropractic College West in Hayward, Dr. Fronko also teaches at Santa Clara University and Ohlone College. The Department is fortunate to have such highly qualified and dedicated part-timers.

The Department depends very heavily upon its lecturers (according to the most recent data available in the self-study, there were 12 employed in the Department as of Fall, 2011 – as opposed to just 7 regular faculty members). The dependence on part-time faculty has grown substantially over the years, as the Department has grown. Fortunately, the Department has dependable, quality instructors who are capable of handling this teaching load, but it does put a strain on the tenure-track faculty members, as there are only 7 of them to handle all of the non-teaching aspects of running a Department (e.g. recruitment of new tenure-track faculty, hiring of non-tenure-track faculty, tenure and promotion committees, advising, etc.) in addition to running their research programs and supervising research students.

Staff

A session was set up for me to meet exclusively with the staff for about 1 hour. 4 of the 5 members of the staff met with me [office administrative assistant Peggy Towers (the other administrative assistant, Jim Anderson, was not available as he is on medical leave); stockroom manager Leanne Thompson, stockroom clerk Yagaya Kumar, and stockroom purchaser/budget analyst Audrey Azevedo] met with me – I was very appreciative that the staff took time out of their busy schedules to meet with me, and particularly that Peggy and Audrey came in on a day (Friday) that they don't ordinarily work, specifically to meet with me. I received some excellent, candid feedback from the staff. It is clear that the staff members are passionate about their jobs and their commitment to the students. One staff member specifically mentioned that she loved working here. They all indicated a strong sense of devotion to the Department and believe in the Department's mission. They spoke to having a good, strong relationship with the faculty, and felt that they worked well with the faculty as a team. They spoke glowingly about the faculty, specifically about how the faculty treated them as colleagues, and expressed their admiration for the faculty's dedication to the students, and the long hours that they put in. The staff also indicated that the faculty had respect for everybody. The staff was also unanimous in their praise of Chair McPartland – they indicated that she consulted with them regularly about issues that affected them and their shops. They seemed to also be realistic about what the Chair was and was not able to do.

The Department is fortunate to have such a capable and loyal staff, which is essential to the running of the program, and central to the mission of the University. There are some concerns with respect to the staff, which I feel are important to mention here. Although superficially 5 staff members would appear to be a reasonable number for a department of this size, 3 of these staff members are not full-time (Peggy is 75% time, Jim is 25% time, and Audrey is 50% time). The staff is actually down 2 full-time positions, one due to a relatively recent retirement, and the other due to the unfortunate death of a technician. One of these positions (an Instruction Support Technician II) has been posted, this technician would be assigned to the Chemistry stockroom. The stockroom manager, Leanne, has not only been managing the stockroom being down one full-time position, but she has been serving as the instrument technician as well – even though she doesn't have the electronics or instrument expertise necessary. She is trying to keep the instruments going, learning on the job, to keep classes and research running. It is admirable of Ms. Thompson to take on this duty as a stopgap measure, but the Department is sorely in need of an instrument technician. Also, Ms. Azevedo has both purchasing duties for the stockroom, as well as her work with the Chair on the departmental budget, despite being only 0.5 time (20 hours per week). The staff also indicated a certain reluctance to using student assistants, both in the departmental office as well as in the stockroom. There seemed to be a feeling that the training of the students took too much time from their regular duties, only to have the students leave after a semester or two.

Students

A period was set up during my schedule to meet with students during the on-campus review. Although there were not a lot of students available on campus on a Friday, I met with 3 students that day. One student was a senior B.S. Biochemistry major, the other two were graduate students working on their Master's degrees (one was currently conducting research, the other was in the process of finishing her thesis). The undergraduate student was planning to work in industry after completing his degree, and ultimately return to do his M.S. degree. One graduate student originally came to the U.S. with a Bachelor's degree in finance from Denmark, and attended CSUEB because she was able to take prerequisite courses in the sciences as a post-baccalaureate student, in order to qualify for graduate school in chemistry. She was very appreciative of this opportunity, but lamented the fact that this option (attending as an unclassified post-baccalaureate student) was no longer available to students. In general, the students seemed to be very happy with the education that they are receiving at Cal State East Bay, and were appreciative of the efforts by the faculty and staff in the Department. Some comments that the students had: 1) they didn't feel that the Career Center on campus was that helpful, in that they didn't have experience in giving advice to chemistry/biochemistry students in terms of employment; and that there was a focus on STEM education, but no guidance given on industrial jobs; 2) the University could use a MESA center, or somewhere for students to go for tutoring in the sciences; 3) the Chemistry Club (Student Affiliate of the American Chemical Society) in the Department is not that strong, students rarely show up for meetings.

Facilities

Facilities may be the greatest obstacle that the Department faces, as the faculty plan for growth in their program for the next 5 years. The Department is already strained with respect to finding the necessary space to conduct research, simultaneous with the steady growth in the number of majors at both the undergraduate and graduate levels, as well as the increase in the number of students taught (FTES) overall. The Department is in the process of recruiting two new tenure-track faculty members, and space will need to be allocated for their research laboratories and offices. The current faculty believes that room can be found for them, given the current space allocation given to the Department. However, serious consideration must be given with respect to any future growth of the regular faculty within the Department – there simply does not seem to be any room to expand into, particularly for research laboratories.

In meeting with Dean Michael Leung, I learned that there are plans for a new science building, referred to as the "Circle Building", which would be modular in its design – to allow for flexibility with respect to future teaching and research needs within the College. I applaud the Dean for championing this project, and for his recognition of the necessity for: 1) additional research laboratory space, 2) faculty office space, 3) facilities for new, modern instrumentation, 4) teaching laboratories. I urge the Dean, and all parties involved in the planning of this project to pay particular attention to the facilities aspect of the new building, to make sure that there is the proper ventilation and air conditioning (including laminar flow hoods), water, electrical capacity, etc. for the purposes of supporting modern day research and teaching labs.

Assessment

In looking over the Department's documentation in the self-study, with respect to assessment, it appears that they have done a very nice job on establishing the student learn objectives (SLOs) for both the overall degree programs as well as for individual courses. In addition, a nice summary of assessment data over the last 5 years was presented. The Department is clearly fulfilling the obligation for WASC accreditation by being on top of the assessment process. In fact, in my opinion, the Department of Chemistry & Biochemistry at CSUEB is significantly "ahead of the game" compared to the departments at several other CSU campuses.

Future Plans

In light of all the wonderful activities that the faculty is bringing to the Chemistry program at California State University East Bay, the question that kept recurring to me is: is this level of activity sustainable as the faculty ages? I recommend that the Department take a deep look at all the directions in which it is going, and in particular to the clientele that it serves, and try to determine a particular direction or two that you wish to focus upon. This could lead to CSUEB Chemistry becoming a recognized "destination campus" for students from outside of the East Bay area. I encourage the Department to

continue to strive to grow the tenure-track faculty, despite the budgetary and space restrictions, as these new faculty members will be the core of the Department for years to come.

Summary

The Department of Chemistry at California State University East Bay have an incredible faculty, who care about, and make time for students. The B.S. and B.A. are strong degree programs, and the Department is making genuine attempts to build upon what is already a good program with their increasing emphasis on undergraduate research. The Department as a whole is doing many wonderful things: they are active and productive in research, engaged in teaching students, etc. The Department is fortunate to have an amazing staff, who work together with the faculty very well as a team. Students seem as a whole to really like the programs here and appreciate the time given to them by the faculty and staff. Concern: I am worried that the junior faculty will reach burn out: is their current productivity sustainable? Also, someone will need to step up and take on the mantle of Department Chair when Chair McPartland decides that it is time to relinquish that role, or when her present term is up. There seems to be a lack of interest or willingness on the part of the other members of the Department to consider this role. This may be due to their strong support of Dr. McPartland as Chair, and/or their belief that she will continue in that role for some time to come (which is hopefully the case), but ultimately one of the "middle aged" faculty members will have to take on this responsibility for the benefit of the Department.

Summary of Recommendations:

- The Department should continue to pursue the hiring of additional, regular tenure-track professors – above and beyond the two that are being recruited this academic year. You need to build up your regular faculty to at least the 65% FTEF figure that Dean Leung is aspiring to for the College.

- The Department is in desperate need of an instrument technician. After hiring the IST II position in the stockroom, the Department should request an additional staff hiring for this area. I see this as one of your highest priorities. I also recommend that Ms. Peggy Towers be promoted to Administrative Analyst, given the level of responsibility that she has been given.

- With respect to your Master's program, I highly recommend eliminating the Plan B option for the M.S. degree. This is a course of action that we (Department of Chemistry at SJSU) followed some years ago, and I believe that it has worked well for us. I understand that there is a belief that you are dependent upon students in the Plan B (no thesis) option for FTES in graduate courses. Therefore, I would recommend that the M.S. Chemistry, Plan B be converted to an M.A. Chemistry degree. The Plan B option diminishes the value of the M.S. Chemistry

degree from CSUEB – by having the non-research degree as an M.A. distinguishes the M.S. degree as a rigorous, research-oriented degree, which would then be recognized as such by other academic institutions, as well as local industry, as such.

- The faculty should (in fact *deserve to*) receive teaching credit for the supervision of research students. This is becoming the norm in the CSU: many campuses are now assigning 0.5 WTU per graduate student (1.0 WTU for a graduate student enrolled in the thesis course) and 0.33 WTU per undergraduate researcher. All research students should take the appropriate research supervision courses for credit, to account for the FTES, and to provide the appropriate insurance coverage for the student as well as liability protection for the Department. For what is presently the Plan B option (perhaps M.A, see above), the Department should institute a "project supervision" course, so that FTEF can be credited to the Department for the supervisory activities by the faculty, and the faculty can get supervision credit for these students (presently, Plan B projects are supervised and review papers are read by faculty advisors, with no teaching credit being given to the faculty, and no enrollment generated for the Department).

- I recommend that the Department take a comprehensive look at the B.S./B.A. degree programs that you are offering. At a time when other CSU campuses have pared down the number of degree offerings that are given by each Department, it seems as though your Department has expanded to seven. As an example, CSU Fresno offers 3 baccalaureate degrees, and San Jose State offers 4. My suggestion would be that you keep the 3 B.S. degrees, and consider consolidating the 4 B.A. degrees that you presently offer into one, or perhaps 2, degrees – but this will certainly be up to you to decide what works best for your Department and students. From the outside, it does seem like a lot of degree programs to offer and keep track of, for a medium-sized department with "only so many faculty members to go around".

- Faculty members should get assigned time for advising of students. This should just not be expected of the faculty, nor expected of every faculty member, and should be above and beyond the 3 WTU "service credits" that the regular faculty receive as part of the overall 15 WTU load (that 3 units should be considered to go towards committee work, and other non-teaching duties necessary in the running of a department).

- The Department should try to re-vitalize the Student Affiliate of the American Chemical Society (SAACS – the Chemistry Club). It would be of great benefit to

have a strong club, that could perhaps take on some departmental functions (e.g. tutoring, planning departmental events, etc.). Ideally, a room dedicated to the use of the Chemistry Club would give the students a place to "call their own".

- I recommend that the Department also strongly consider using student assistants in both the Departmental office and Chemistry stockroom. While it is true that some time is required to be invested in these students in training them, student assistants would free up time for the stockroom and office personnel. For instance, if students can be trained to answer phones and greet visitors to the office, some questions can be answered simply, leaving more time for the administrative assistants to do their jobs uninterrupted. Similarly, students manning the stockroom window would free up Yagaya to do other duties. The initial training is indeed a big investment, but ultimately, if students can be hired to overlap, the new incoming students can learn from those who have already been doing the job, and hence less training is required.

- **Space Audit for Entire Department**. The Department should conduct an extensive space audit of all space assigned to the Chemistry Department. Perhaps there can be more innovative use of the current teaching labs. This would be useful with respect to documenting the need for future space, and with respect to the planning for a new building.

- **Start-up packages for New Faculty Recruitment.** I would like to recognize the President, Provost, Dean for their past commitment to excellent new faculty, and the support that they have given them to jump start their research programs; and I would like to encourage them to do even more with respect to start-up packages (funding and release time) to help new hires establish their research programs. Some CSU campuses are offering start-up packages of $100-150K, or more. I know that coming up with this level of funding is difficult, especially in light of the current economic climate, so I recognize that this would be a serious effort on the part of the administration to support research and scholarship, and to attempt to take CSU East Bay to "the next level". I encourage all parties to, at the very least, improve upon start-up packages to attempt to attract the best new faculty.

- **Alumni Database.** One way to establish the efficacy of the Department's programs is to keep close tabs on the alumni from the Chemistry degree programs, and chart the success of these former students. The Department may have done some of this – I suggest continuing to try to get data documenting the success of your graduates (i.e. medical school, graduate school, pharmacy school graduates, etc.). This can be included as part of your departmental assessment.

- **Internship Programs**. The Department could consider an internship program for those not currently doing undergrad research (senior project).

- **Diversification of the Faculty.** How can the Department address increasing ethnic diversity of its student population? What is the Department doing for outreach to recruit Hispanic faculty (to reflect the local population)? We encourage the Department to actively engage in communication with minority organizations such as SACNAS (the Society for the Advancement of Chicanos and Native Americans in Science) and NOBCChe (the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers), including the possibility of sending faculty members to national meetings for the purpose of recruitment.

- **Future Focus.** Consider what the Department can do to both "specialize" in one or two areas, and become a destination program for students, rather than attempting to be "all things to all people."

5. Program Response to External Reviewer's Report

On February 15, 2013 Dr. Bradley M. Stone, Professor and former Chair of the Department of Chemistry at San Jose State University, visited the Hayward campus of CSUEB to perform an on-site review of our department. He met with the Dean of the College of Science, the Department chair, Department faculty, including part-time lecturers, Department staff, and chemistry and biochemistry students. The Department faculty have read and considered the External Review Report submitted by Dr. Stone. Our responses to various components of the Report follow.

Introduction

The External Reviewer's report describes the current state of affairs in the Department of Chemistry and Biochemistry, pointing out many strengths and providing suggestions for improvements and/or new directions. It also urges the Department to seek additional resources in several areas. At the end of the report Dr. Stone makes a series of specific recommendations for the future. The topics covered in the Department response are organized according to the outline of Dr. Stone's report.

A. Department Overview and Current Curriculum

The Report overview is very complimentary, stating that the Department is providing an outstanding educational environment for students. It particularly compliments the faculty and staff and finds the department at CSU East Bay to be comparable and of similar high quality to several other well respected chemistry departments within the CSU, including those at Sonoma State, Sacramento State, San Francisco State and San Jose State.

Need for tenure track faculty. Dr. Stone notes the low percentage of tenure track faculty FTEF (46%) compared to lecturer FTEF and comments that the two tenure track searches in progress are welcome but will leave the Department far from the ideal of 75-80%. He acknowledges that other CSU campuses are suffering low percentages of tenure track faculty also because of the poor economic climate but mentions that the number of CSU East Bay (CSUEB) Chemistry faculty is on the low side needed to run a department our size. Dr. Stone's comments about the shortage of tenured and tenure track (TT) faculty mirror those presented in our Self Study.

Undergraduate degree programs and ACS Accreditation of B.S. Chemistry degree. Dr. Stone's report reviews the seven undergraduate degree options offered by the Department. The first degree he discusses is the B.S. Chemistry program, which is accredited by the American Chemical Society (ACS) and is a rigorous degree equivalent to B.S. Chemistry degrees offered around the country. He encourages us to maintain this degree and certification with the ACS. Maintaining ACS accreditation requires that the Department have sufficient tenured and TT faculty to teach all of the courses required for the B.S. Chemistry major. At present we are not quite able to fulfill this requirement, but have managed to retain ACS accreditation anyway.

Because we were admonished by the ACS during the last accreditation cycle to offer the Advanced Inorganic Chemistry series every year instead of every other year, we have included that goal in the Plan section of this Review document. The goal of offering Advanced Inorganic Chemistry more often is facilitated by recent increased enrollments and the hiring of a TT Inorganic Chemist for Fall 2013. To have all of the courses required for the B.S. Chemistry degree taught by tenured/TT faculty will require another faculty hire. The need for new TT faculty is a recurring theme in the Self Study and Plan sections of this document and is also mentioned several times in the External Reviewer's Report.

Dr. Stone's report comments favorably on the two other B.S. degrees offered by the Department (B.S. Chemistry, Option in Forensic Science and B.S. Biochemistry) as solid degrees providing a strong background in chemistry and/or biochemistry. However, he notes that the Department offers four different B.A. degrees and questions whether all four are necessary. He worries that seven baccalaureate programs are too many for seven tenured/TT faculty to handle.

Two of the B.A. degrees are Chemistry Education Options which are part of a larger effort by the College of Science to promote the training of future secondary school science teachers. The Department faculty are actually comfortable offering and managing the four B.A. degrees. The rationale for these degrees is discussed in more detail in the Summary of Recommendations section of this document.

B. Department Chair, Full Time and Part Time Faculty

After speaking with faculty and staff during the on-site visit, Dr. Stone concluded that the current chair has the support of the department. He also observed that the tenured and TT faculty are a very cohesive group and very active in a variety of areas such as teaching, advising, research supervision of undergraduates and Master's candidates, committee work, outreach and assessment. He reiterated how impressed he is with the dedication of our faculty to the students at CSU East Bay.

The report again makes the point of how heavily the Department relies on part time lecturers. Although Dr. Stone was impressed with the lecturers he met during the site visit, he comments that the heavy use of lecturers puts a strain on the tenured/TT faculty who must "handle all the non-teaching aspects of running a department." The Chemistry and Biochemistry faculty certainly concur.

C. Staff and Students

The External Reviewer's report praises the staff for their collective sense of dedication to the Department's mission. In his interviews with the staff, Dr. Stone gained the impression, which is quite true, that the faculty and staff work well together as a team. One of the strengths of the Department is the excellent relationship between our faculty and staff.

Staff Issues. Dr. Stone did, however, describe some concerns regarding staffing. Several of the staff members (3 of 5) hold only part time positions. The total time base for the Department office staff is 1.0, down from 1.5 several years ago, despite increases in enrollment. The number of instructional support technical (IST) staff members is down due to the 2009 retirement of a manager/instrument technician who was not replaced. The IST staff are normally responsible for preparing materials for the laboratory classes. This involves making chemical solutions, handling chemical waste, setting up equipment, and maintaining instruments. The past year has been especially challenging because of the death of another IST. Fortunately the hiring of his replacement is in progress, but since the earlier retirement four years ago the department has been without an instrument technician.

Dr. Stone states that the Department is sorely in need of an instrument technician and the Department faculty strongly concur (see section 3.4 of Program Plan). The current staff are struggling to maintain the instruments we have and the faculty have hesitated to acquire the new instruments needed to modernize our courses because of the absence of a technician to maintain them. Large instruments take several days to be made operational after sitting idle and require frequent calibration. An IST with the time to keep the instruments in working order is essential.

Student Concerns. On the day of the site visit Dr. Stone met with several chemistry and biochemistry majors who seemed generally happy with the education they are receiving at CSU East bay. A few concerns were voiced regarding lack of good advice on science jobs by the campus career center, a need for tutoring in the sciences and the relative inactivity of the current Department Chemistry Club (Student Affiliate of the American Chemical Society).

It is possible the students who spoke with Dr. Stone were not fully aware of the campus services provided by the Academic Advising and Career Education (AACE) center. This campus center offers a variety of counseling services for job seekers, provides links to internship sites and job listings of various kinds, and holds three job fairs a year. Companies that hire chemistry and biochemistry graduates are invited to participate in the fairs and usually do so. Additionally, the Student Center for Academic Advising (SCAA) offers e-tutoring in many subjects, including chemistry, to all CSUEB students.

To address these student concerns, the Department office staff and faculty major advisors will make more of an effort to apprise students of the available career and tutoring services. The Department chair will also contact AACE to seek information on how science majors are being served. We will amend the Five Year Plan to make these actions a priority. The student concerns regarding the current state of the Chemistry Club will be addressed under Summary of Recommendations.

D. Facilities

Dr. Stone noted the shortage of additional space for handling the increasing numbers of students taking laboratory classes in chemistry (increasing FTES) and for research accommodations for new tenure track faculty. In his report he states that this "may be the greatest obstacle the Department faces." The Department faculty definitely concur with Dr. Stone on this point. In speaking with Dean Leung, Dr. Stone learned of plans for a new, relatively small Science Building (the Circle Building) that could alleviate some of the problem and applauds Dean Leung for his efforts. Other creative solutions also need to be sought for this very serious problem. The shortage of space is limiting not only the number of lab course sections that can be offered and the professional activity possible for new faculty, but also the types of instrumentation that can be housed in the Department.

E. Assessment

The External Reviewer's report compliments the Department efforts on assessment, both for the quality of the student learning outcomes in the assessment plan, and for the summary of assessment data presented in the Self Study (2.2) and Appendix B. Dr. Stone states that the "Department is clearly fulfilling the obligation for WASC accreditation by being on top of the assessment process." The Department faculty are very pleased to hear this praise. We are actually hoping to improve the assessment plan in terms of being able to better compare data from year to year and better align the student learning outcomes with those of the university as a whole and the American Chemical Society (see Plan, section 3.1-d). We hope the proposed changes will make it easier to identify key areas in our curricula where we are doing a good job versus those where we need to make improvements in student learning.

E. Future Plans and Summary

In these sections of the report, Dr. Stone reiterates his praise for the Chemistry and Biochemistry faculty. He finds we have an "incredible faculty who care about and make time for students, who are active and productive in research, engaged in teaching," and involved in committee work, advising and community outreach. In fact he notes that the young faculty are so active there is a possibility of burnout. To stave off this possibility he suggests the department continue to try to grow in terms of new tenure track faculty and consider focusing efforts in a particular direction or two. These suggestions are again listed under Summary of Recommendations and will be discussed there.

The Reviewer also mentions the need to groom a successor to Department Chair McPartland. Several of the current faculty members have an active interest in formulating departmental policies and have served the Department and the University in areas such as curriculum development, lecturer training, faculty and staff hiring, assessment, the graduate program, retention and promotion, and faculty affairs. One of these members could and will step up as Chair of the Department when Dr. McPartland steps down.

Responses to Recommendations Listed under "Summary of Recommendations"

At the end of his report Dr. Stone lists a series of specific recommendations for the Department of Chemistry and Biochemistry. The Department faculty met and discussed each recommendation. Below please find the Department perspectives and responses to each of the recommendations.

1. **Continue hiring tenure track faculty to reach at least 65% tenured or tenure track FTEF.** The faculty could not agree more and have included this as a goal in the Plan portion of this Program Review (section 3.1).

2. **After filling the IST II position in the chemistry stockroom, request an additional staff position for an instrument technician. Request promotion of department ASA I (Ms. Peggy Towers) to the ASC level.** The Department faculty are in full agreement with both these suggestions. Our stockroom manager/instrument technician retired four years ago and was not replaced. This has caused a real deficiency in the department's ability to utilize and acquire instrumentation for use in laboratory classes. The faculty also agree that Ms. Towers should be promoted; the Chair plans to make this request.

3. **Eliminate the Plan B Option for the M.S. Chemistry degree and replace it with an M.A. Chemistry degree.** The Department offers both thesis (Plan A) and non-thesis (Plan B) versions of the M.S. Chemistry degrees. The Plan B students are required to complete more regular (non-research) courses than the Plan A students, do a literature review and write a comprehensive review paper, defend the paper in an oral exam, and pass exit exams in multiple areas of chemistry. The Plan A option can be considered more rigorous in the sense that students must complete a research project and write a thesis describing their results. Completing an independent research project is indeed difficult and helps build the skills needed to be a hands-on research chemist or biochemist. But the Plan B options are also rigorous programs.

   The question of whether the Plan B students should earn an M.S. degree is arguable and our faculty appreciate Dr. Stone's thoughts on this matter. The Plan B program was originally designed for individuals already employed in industry and performing research experiments in their daily work. The majority of the graduate courses are offered in the late afternoon or evening especially to serve these students. The Department faculty think these students appropriately earn an M.S. degree.

   We agree that students with no previous research experience who matriculate in a Plan B option are not receiving proper training in research methodology. As the graduate program has grown and the number of tenured/TT faculty has decreased, it has been difficult to provide research supervisors for all the students who should be in a Plan A option. We would like to postpone any change to an M.A. degree and instead strongly encourage students to choose the M.S. Plan A option if they are entering graduate school without previous research experience. This will be more feasible now that we

have hired two new research active faculty members who will join our department in Fall 2013 and have also been approved to hire another chemist for Fall 2014. We hope to retain the M.S. Plan B option for working chemists and biochemists and at the same time provide the appropriate Plan A training for the other students. If this becomes too difficult to accomplish with the available resources, we will again consider developing an M.A. degree program.

4. **The faculty should receive teaching credit for the supervision of research students; research students should take the appropriate research supervision courses for credit.** The Chemistry and Biochemistry faculty strongly agree with Dr. Stone that faculty should receive teaching credit for supervision of research students. Up until four years ago each faculty member could receive up to 2 WTU per year for supervising research at the rate of 0.5 WTU for each supervisory course taken by a graduate student and 0.33 WTU for each undergraduate. The request to reinstate these 2 WTU per year of supervisory units is in the Plan section of the Program Review document (section 3.3).

   Dr. Stone was given the wrong impression on the day of his visit regarding research supervision courses. Research students do currently take courses for credit. Every student doing a research project under the supervision of a faculty member signs up for a Special Registration course, whether it be Independent Study (CHEM 4900, 6900), Undergraduate Research (CHEM 4810), Methods in Graduate Research (CHEM 6850), Research (CHEM 6830) or Thesis (CHEM 6910). Plan B graduate students receive credit for the comprehensive review paper under CHEM 6850 and credit for preparing for the comprehensive exams through CHEM 6901. These courses provide FTES for the university; faculty should receive some teaching credit for them.

5. **Consider consolidating the four B.A. programs into one or two degrees.** Dr. Stone notes that the Department offers four different B.A. degrees and questions whether all four are necessary. He worries that seven baccalaureate programs are too many for seven tenured/TT faculty to handle and recommends consolidating the B.A. degrees into one or two.

   The Department faculty are actually comfortable offering and managing the four B.A. degrees. For the most part, the B.A. course requirements are similar to those for the B.S. degrees but with fewer math and upper division chemistry requirements. Only two chemistry courses are specific to the B.A. degrees (CHEM 3501, Biophysical Chemistry and CHEM 4400, Instructional Activities in Chemistry).

   The rationale for offering the Chemistry Education Options was not properly explained to Dr. Stone during the external review. The B.A. Chemistry, Option in Chemistry Education and B.A. Biochemistry, Option in Chemistry Education degrees are part of a larger effort by the College of Science to promote quality training of future secondary school science teachers. Our B.A. Chemistry Education programs include courses in Geology, Environmental Chemistry, Philosophy, Teacher Education and Biology required as prerequisites for a Secondary School Teacher

Credential program in Chemistry. These degrees are paired with B.A degrees offered by the Departments of Biological Sciences and Physics. Those degrees provide Options in Biology Education and Physics Education, respectively. The College does not have a Natural Sciences Department to offer teacher preparation in the sciences and therefore the Chemistry, Biological Sciences and Physics Departments have decided to take up this mission.

The B.A. Chemistry and B.A. Biochemistry are basic degrees, less rigorous than the B.S. versions of these programs, but still providing specialized training in chemistry or biochemistry. These degrees leave room for students to pursue courses in other fields. As Dr. Stone notes, the statistics provided in our Five Year Program Review don't distinguish B.S. versus B.A. majors, but our Department records show that for the last two years nearly half of the chemistry majors earned the B.A. Chemistry degree. Thus, this is a relatively popular degree. The B.A. Biochemistry is admittedly much less popular than the B.S. Biochemistry degree, with only about 20% of the students choosing the B.A. Nevertheless, we are happy to offer this option to students who need solid training in biochemistry but prefer to leave room in their programs for coursework in other fields.

6. **Faculty should get assigned time for advising students. Advising should be considered above and beyond the 3 WTU service credits that regular faculty receive as part of a 15 unit load.** This is a wonderful suggestion. The Chemistry faculty certainly would appreciate assigned time for advising.

7. **Try to revitalize the Student Affiliate of the American Chemical Society, the Chemistry Club or Alchemist's Club, as it is known on our campus.** This year's club is not very active, but it would be incorrect to say our Alchemist's Club is usually weak. The vitality of the club varies from year to year. For example, two years ago we had a very active club that helped the local community through the Habitat for Humanity program. The students helped to rebuild homes. Last year's club organized a group of volunteers who served as hosts for the exhibits for the College Science Festival. A Faculty Advisor is elected each year to advise and mentor the club, but the quality of the club depends to a large extent on the enthusiasm of the students.

   In keeping with Dr. Stone's recommendation we will work harder to motivate the students, perhaps by suggesting specific activities. Some things that come to mind are judging local high school and middle school science fairs, organizing a forum for representatives from the Academic Advising and Career Education center to speak to undergraduates about job opportunities, volunteering to host exhibits for the Fall 2013 Science Festival, and providing tutoring for younger students. We have amended the Five Year Review Document to include the goal of strengthening the Alchemist's Club.

8. **Consider using Student Assistants in the Departmental Office and the Chemistry Stockroom.** The Chemistry and Biochemistry faculty are split as to whether they

agree with this suggestion. The prevalent feeling is that we should hire student assistants only when they will be directly supervised by a permanent staff member and the staff member willingly takes on that responsibility. There is a concern that a student working in the department office would have access to private files and exams. The faculty would therefore limit student working hours to those when the supervising permanent staff member is present.

9. **Conduct an audit of the space currently assigned to the Chemistry and Biochemistry department.** The department agrees with Dr. Stone that this is a good way to document the need for future space and does plan to conduct such an audit.

10. **Improve the start-up packages for new faculty.** Dr. Stone applauds the President, Provost and Dean for past start-up support and encourages them to provide even more support in terms of funding and release time. The Department faculty concur.

11. **Establish a Department Alumni Database in order to chart the success of former students.** The Department faculty think this is an excellent recommendation and it has been incorporated into the Five Year Review Plan. In earlier years the department kept an alumni database but during staff reductions this was not kept up. We would like to revive it, this time taking advantage of the Linked-In web site to maintain contact with our alumni. This is a project that could certainly involve a student assistant.

12. **Consider an Internship Program for students not currently doing undergraduate research.** Working in an internship or related endeavor involving chemistry or biochemistry during the college years is an important step in preparing for work or advanced study after graduation. The Deans of the College of Science at CSU East Bay have negotiated several summer internship opportunities at local government laboratories specifically for CSU East Bay students. Each year some of our majors apply for and are chosen for internships at Lawrence Livermore National Laboratories, Sandia National Laboratories and the NASA-Ames Research Center.

    Additionally, students have the opportunity for outreach work in science in local middle schools and high schools through CHEM 4400, the Instructional Activities in Chemistry course established recently. One of our faculty members (Dr. LeDuc) interacts with many local teachers through her Science Education work and can easily place students who wish to participate. For students who are already employed in industry, we offer Cooperative Education courses that provide an opportunity to obtain course credit for work related to chemistry. Students are required to work with a faculty mentor who helps them prepare thoughtful reports on the significance of the work they accomplish.

13. **Diversification of the Faculty.** We agree with Dr. Stone that it important to recruit faculty that match the ethnic diversity of our students, and the Department has been working to recruit a diverse faculty. In the two tenure track searches just completed

we advertised with the Society for Advancement of Chicanos and Native Americans in Science and the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers. We also contacted Chemistry chairs at several predominantly African American Colleges to solicit quality applicants. The final pool of candidates for each search was fairly diverse. We are happy to welcome two new tenure track faculty of Asian descent to our Department for Fall 2013.

14. **Future Focus-consider specializing in one or two areas to become a destination program.** The faculty found this to be a very interesting suggestion and worth consideration. As mentioned above, we would like to be a department that facilitates preparation of graduates for careers as high school science teachers. On the other hand, in a small department it is difficult to have enough faculty to teach each area of chemistry for the major and service courses and at the same time specialize. For now we think it is important to make sure each area of chemistry is represented in the numbers necessary to teach the classes and ensure continued accreditation by the American Chemical Society. In areas such as physical and inorganic chemistry where we need several faculty to cover the classes, it may well be worthwhile to attempt to hire in a particular sub-discipline in order to develop a notable specialization.

Appendix A

Program Assessment Plan

Mission Statement

The Department strives to provide a strong education in chemistry and biochemistry that prepares its students to function and thrive in our society. The Department attempts to increase the problem solving and critical thinking skills of all students. Non-science students will learn about the scientific and chemical aspects of everyday life that allow them to understand issues related to the environment, energy production, disease prevention and nutrition. Students of the sciences will learn the fundamentals of chemistry that control the interactions of elements and molecules that form the building blocks in nature. Chemistry majors will receive extensive instruction in predicting chemical reactivity. Building on an understanding of mathematics, physics, and biology, chemistry majors will receive a background in the major disciplines of chemistry including inorganic, analytical, organic, physical and biochemistry. Students will learn the protocols and techniques for working safely with chemicals. All chemistry majors should have the ability to search the chemical and scientific literature. The Department recognizes the importance of the pursuit of new knowledge through research in the development of skilled scientists and productive members of society and encourages its students to participate in research projects and cooperative educational opportunities.

Alignment of Department Goals with University Mission

Our program aims are well aligned with the university mission of providing an academically rich learning experience that prepares students to realize their goals, pursue meaningful work and contribute to their community. We strive to offer a broad range of chemistry and biochemistry courses that not only cover basic principles but also explore specialized areas and include recent advances. We want our graduates to be prepared to succeed in a variety of career choices, whether it be work in the chemical or pharmaceutical industry, or further training in graduate programs in chemistry or biochemistry or in medicine, dentistry or other health professions. We recognize the fast pace of research in chemistry, and especially biochemistry, and try to prepare our students to embrace new concepts and to appreciate advances in experimental methods and instrumentation. In our major-level courses, we encourage students to think critically about the use of chemicals in society and about the responsibilities of scientists to contribute to societal issues relating to chemistry and biochemistry. Through our General Education program, we attempt to give non-science majors a solid introduction to chemistry and the scientific method, with emphasis on how chemistry is used in modern life. We hope to engage these students in a sustained interest in chemistry that can help them become informed citizens.

Student Learning Outcomes for
BA-Chemistry and BS-Chemistry Degrees

It is imperative that CSUEB chemistry students possess sufficient theoretical and practical training in chemistry and biochemistry so that they will be able to assume the significant technical responsibilities required by the chemical and biotechnology industries that will employ them. It is important that our students are not only trained in chemistry but will become respected scientists and research technicians. In addition, it is important that students planning for entrance into graduate school or pre-professional school are more than adequately prepared for post-baccalaureate training.

General Learning Objectives:

Chemistry students should have:
(1) an understanding of the importance of and reason for course prerequisites.
(2) a solid background in advanced mathematics (calculus), physics, and computers.
(3) a solid background in the various areas of chemistry, including: general chemistry, analytical chemistry, organic chemistry, physical chemistry, and biochemistry.
(4) an ability to think critically and to analyze chemical problems.
(5) an ability to work effectively in a laboratory environment and to use modern chemical/biochemical instrumentation and procedures.
(6) an ability to use computers in experiments, data analysis, and in communication.
(7) an ability to work with people in teams to solve chemical problems.
(8) an ability to communicate effectively, both orally and in writing.
(9) an ability to function effectively in their chosen career.

Learning Outcome No. 1: Chemistry students should have a strong background in lower division advanced mathematics (calculus), physics, and computers.

It is the opinion of the faculty of the Department of Chemistry and Biochemistry that a consistent pattern of excellent grades is the best indicator of mastery of the subjects that provide the foundation for the learning of chemistry. Grades provide an excellent indicator of future mastery of chemical and biochemical information. Students should understand the reason for course prerequisites and need to complete specific courses (and course sequences) in the pattern indicated in the catalog.

Learning Outcome No. 2: Chemistry students should have a solid background in the various areas of chemistry: general chemistry, analytical chemistry, organic chemistry, and physical chemistry.

The faculty of the Department of Chemistry and Biochemistry will utilize embedded exam questions in chemistry lecture and laboratory courses to assess student learning in the above areas of chemistry.

Learning Outcome No. 3: Chemistry students should have a solid background in modern chemistry laboratory methods and procedures.

Chemistry 3303 (Organic Chemistry) will be the capstone course for the BA-Chemistry Degree and BS-Chemistry Degrees. The faculty will utilize the ACS exam to assess student learning. Laboratory reports will also be utilized to assess student learning and performance.

Student Learning Outcomes for BA-Biochemistry and BS-Biochemistry Degrees

It is imperative that CSUEB biochemistry students possess sufficient theoretical and practical training in chemistry and biochemistry so that they will be able to assume the significant technical responsibilities required by the chemical and biotechnology industries that will employ them. It is important that our students are not only trained in biochemistry, but will become respected scientists and research technicians. In addition, it is important that students planning for entrance into graduate school or pre-professional school are more than adequately prepared for post-baccalaureate training.

General Learning Objectives:

Biochemistry students should have:
(1) an understanding of the importance of and reason for course prerequisites.
(2) a solid background in advanced mathematics (calculus), statistics, physics, computers, and biology.
(3) a solid background in the various areas of chemistry, including; general chemistry, analytical chemistry, organic chemistry, physical chemistry, and importantly, biochemistry.
(4) an ability to think critically and to analyze chemical problems.
(5) an ability to work effectively in a laboratory environment and to use modern chemical/biochemical instrumentation and procedures.
(6) an ability to use computers in experiments, data analysis, and in communication.
(7) an ability to work with people in teams to solve chemical problems.
(8) an ability to communicate effectively, both orally and in writing.
(9) an ability to function effectively in their chosen career.

Learning Outcome No. 1: Biochemistry students should have a solid background in the various areas of chemistry: general chemistry, analytical chemistry, organic chemistry, and physical chemistry.

The faculty of the Department of Chemistry and Biochemistry will utilize embedded exam questions in chemistry lecture and laboratory courses to assess student learning in the above areas of chemistry.

Learning Outcome No. 2: Biochemistry students should have a solid background in biochemistry.

Specifically, biochemistry students should:

(1) understand the structure and function of the basic molecules found in living cells (eg. amino acids, peptides, proteins, enzymes, carbohydrates, lipids, nucleotides, hormones).
(2) understand cell metabolism and its regulation (eg. glycolysis, gluconeogenesis, Krebs cycle, electron transport/oxidative phosphorylation, lipid metabolism, protein/amino acid metabolism, and nucleotide metabolism).
(3) understand enzyme structure, function, and kinetics.
(4) understand DNA and RNA structure and function, DNA replication, and RNA transcription.
(5) understand protein synthesis.
(6) understand the structure, function, and metabolism of other biological molecules (e.g. hormones, heme, and cofactors).

The biochemistry faculty will utilize embedded exam questions in the General Biochemistry 4411, 4412, 4413 course sequence to assess student learning.

Learning Outcome No. 3: Biochemistry students should have a solid background in modern biochemistry laboratory methods and procedures.

Specifically, biochemistry students should:
(1) understand the basic theoretical and practical issues involved in the analysis of biological molecules, including pipetting, solution preparation, buffer preparation, protein purification, centrifugation, spectrophotometric assays, enzyme assays, chromatographic procedures, electrophoresis, and the analysis and manipulation of DNA and RNA, PCR procedures, and plasmid preparation.
(2) understand scientific literature searching procedures.
(3) understand laboratory notebook and report preparation, data analysis, and the use of computers.
(4) understand the basics of laboratory safety.
(5) understand scientific/academic honesty and ethical issues.

Chemistry 4430 (General Biochemistry Laboratory) and Chemistry 4431 (Advanced Biochemistry Laboratory) will provide students with strong training in the procedures noted above. Chemistry 4430 will be the capstone course for the BA-Chemistry (Option in Biochemistry) Degree, and both Chemistry 4430 and Chemistry 4431 will be capstone courses for the BS-Biochemistry Degree. The biochemistry faculty will utilize embedded exam questions in these courses to assess student learning. In addition, the biochemistry faculty will require an extensive laboratory notebook for each of these two courses. The notebook will detail laboratory procedures, data, data analysis, and conclusions. The laboratory notebook and an evaluation by the instructor of the student's laboratory skills will constitute further assessment of learning.

Student Learning Outcomes for
MS - Chemistry (Plan A)
MS-Chemistry (Option in Biochemistry, Plan A)
MS - Chemistry (Plan B)
MS-Chemistry (Option in Biochemistry, Plan B)

It is imperative the CSUEB chemistry students possess sufficient theoretical and practical training in chemistry and biochemistry so that they will be able to assume the significant technical responsibilities required by the chemical and biotechnology industries that will employ them. It is important that our students are not only trained in chemistry (and biochemistry) but will become respected scientists and research technicians. In addition, it is important that students planning for entrance into Ph.D. programs or pre-professional programs are more than adequately prepared for entrance into these programs.

Learning Outcome No. 1: Newly-admitted chemistry graduate students should be prepared and ready to study chemistry at the graduate level.

All newly admitted chemistry graduate students are expected to take a chemistry placement exam within the first quarter of their initial admission into the program. This exam covers general/inorganic chemistry, organic chemistry, physical chemistry, and biochemistry. It is administered on a monthly basis by the Department Graduate Coordinator. Students failing the exam (or a portion of the exam) must complete undergraduate chemistry coursework by enrolling in organic chemistry, physical chemistry, or biochemistry courses (and passing coursework with a grade of B or higher).

Learning Outcome No. 2: Chemistry graduate students should have a solid background in advanced chemistry.

Depending upon the Degree Plan/Option, chemistry graduate students must complete coursework in thermodynamics, the chemical bond, biochemistry, and various advanced topics in chemistry (in organic chemistry, physical chemistry, and/or biochemistry).
For Plan A or Plan B Chemistry programs, assessment of student learning will be conducted in Chemistry 6521 (The Chemical Bond). Chemistry graduate students completing this course should have a solid understanding of the quantum mechanical description of the atom and of chemical bonding found in molecules. The faculty will utilize embedded exam questions to assess student learning.
For Plan A or Plan B Option in Biochemistry, assessment of student learning will be conducted in Chemistry 6430 (Protein Chemistry Techniques). Chemistry graduate students completing this course should have a solid background in the laboratory methods necessary to isolate, purify, and analyze proteins. The faculty will utilize embedded exam questions to assess student learning.

Learning Outcome No. 3: Chemistry graduate students should have significant experience in laboratory research methods. Chemistry graduate students should be able to present complex chemical information via oral and written reports.

All four Chemistry Plans/Options have extremely strong laboratory research course requirements. Therefore, depending on the Plan/Option, chemistry graduate students will

have completed several research-based courses, including; Chemistry 6830 (Research, 3-6 units), Chemistry 6850 (Methods of Graduate Research, 3 units), Chemistry 6910 (University Thesis, 3 units), Chemistry 6430 (Protein Chemistry Techniques, 4 units), Chemistry 4700 (Survey of Chemical Literature, 2 units), and Chem 4240 (Instrumental Methods of Analysis, 4 units). In addition, students could complete Chemistry 6900 (Independent Study, 1-3 units), Chemistry 4430 (General Biochemistry Laboratory, 4 units), and Chemistry 4431 (Advanced Biochemistry Laboratory, 2 units).

All chemistry graduate students must complete three separate Chemistry Seminar courses (Chemistry 6820, 1 unit each). Students will be expected to select a topic in chemistry or biochemistry, search the literature, develop an oral presentation (using a computer Powerpoint presentation), and answer questions. The seminar is presented to fellow students and to the faculty. The faculty member coordinating the Chemistry Seminar will evaluate each student seminar with respect to scientific content, oral presentation, proper use of visual-aids, and ability to answer questions about the topic.

Depending on the Plan/Option, all chemistry graduate students must complete coursework requiring written reports. Chemistry 6830, 6850, 6901, and 6910 all require formal written reports. In addition, Chemistry 6430 requires written laboratory reports or a laboratory notebook. The supervising faculty will carefully read, review, and edit student reports and assess writing skill.

Learning Outcome No. 4: Chemistry graduate students should be able to successfully complete a capstone project.

Plan A - University Thesis (Chemistry 6910)
Plan B - Comprehensive Examination (Chemistry 6901)

Plan A chemistry graduate students will be expected to submit a completed, well-written University Thesis. The thesis should conform to Department and University guidelines and should document the research topic, background information, research methods, research data/results, conclusions, and references. The thesis will be carefully reviewed by the supervising faculty adviser and thesis committee members. The signed/dated Signature Page of the final draft of the thesis will be considered as the primary assessment criterion, signifying completion of the capstone project and demonstrating significant learning performance.

Plan B chemistry graduate students will be expected to complete Chemistry 6901 (Comprehensive Examination) as the capstone project for the MS - Chemistry Degree. This includes completion of a literature review paper with extensive literature references, an oral examination covering the review paper, and passing a comprehensive written exam. Faculty committee members will review the paper and will also administer the oral exam. The successful completion of a well-written review paper, passing of the oral exam, and passing the comprehensive written exam will be considered as the primary assessment criteria, signifying completion of the capstone project and demonstrating significant learning performance.

Specific Learning Outcomes for Chemistry and Biochemistry Courses

The Department of Chemistry and Biochemistry has defined Goals and Objectives for the upper division courses in its Degree Programs:

Chem 3301, 3302, 3303 Organic Chemistry

Students who successfully complete this series of courses should:

1. be able to predict bonding, nomenclature, chemical properties and some physical properties of organic compounds if the molecular structure is known.
2. be able to identify common organic functional groups and show a knowledge of the chemistry and reactivity of each functional group.
3. be able to use the results of the common spectroscopic methods (NMR, IR, UV and mass spectroscopy) to determine the structures of simple organic compounds.
4. know and understand the common reaction mechanisms of organic reactions, and be able to indicate the mechanism and type of intermediate involved in the reactions.
5. be able to safely carry out standard laboratory techniques for the purification of organic compounds, including distillation, recrystallization, gas chromatography, thin layer chromatography, and extraction.
6. be able to measure the infrared spectrum of an unknown solid or liquid and be able to identify the functional groups present.
7. be able to carry out standard functional group transformations of organic compounds, and isolate and characterize the resulting products.

The Outcomes Criteria for objectives 1-4 will be based on the score obtained on the American Chemical Society standardized Organic Chemistry Exam. The exam will be given as the final exam in Chem 3303. A satisfactory criterion will be a class average at the 45^{th} percentile or higher.

The Outcomes Criteria for objectives 5-7 will be based on a capstone assignment for Chem 3303 laboratories. Students will identify two unknown organic compounds, one solid and one liquid. This will require purification by distillation, the knowledge of chemical reactivities and classification tests, the ability to obtain spectroscopic data, especially FT-IR, and the ability to interpret the results. At least one derivative will be required, requiring a chemical transformation and purification and characterization of the product. A satisfactory criterion will be correct identification by 90% of the students.

Chem 3511, 3512, 3513 Physical Chemistry

Students who successfully complete this series of courses should:

1. understand how reaction energies are measured.
2. understand the properties of the gas phase and the relationship to energy.
3. be able to correlate bond energies with macroscopic energy determinations.

4. recognize the driving force for chemical reactions.
5. understand the concept of equilibrium as it is applied to various reactions.
6. be able to explain the origin of quantum theory.
7. be able to describe the nature of the electron in the hydrogen atom.
8. be able to describe the building up of the periodic table by electron configuration.
9. be able to correlate the changes observed in spectroscopic methods in terms of quantum theory.
10. understand the importance of rates of chemical reactions in the overall scheme of chemistry.
11. be able to calculate reaction order from the time dependence on concentration.
12. be able to understand and describe transition state theory.
13. understand the nature of solids in terms of their nature, bonding, and properties.
14. understand how statistics and probability can be used to develop thermodynamic concepts.

The Outcomes Criteria will be based on the answers obtained for specific question on the Physical Chemistry Standardized Exam.

Chem 3531, 3532 Physical Chemistry Laboratory

Students who successfully complete this series of courses should be able to:

1. make solutions, perform spectroscopic measurements, and test physical chemistry principles using various types of laboratory equipment.
2. keep a clear laboratory notebook in which they describe objectives and procedures, and tabulate data.
3. understand the error inherent in measurement, and be able to determine the magnitude of the resulting error in a calculated quantity.
4. plot data to determine trends using linear and non-linear fitting.
5. compare their experimental results with those from the literature.
6. perform computer modeling calculations as simulations to support experimental data.
7. apply chemical principles of thermodynamics, quantum mechanics and kinetics to understand the significance of the experiments done in the laboratory.
8. write laboratory reports in the format of journal articles, including sections describing introduction, experimental, results and discussion, and conclusions.
9. carry out a literature search on a current topic, and present the results to classmates.

The Outcomes Criteria for objectives 1-2 and 6 will be based on evaluation of the laboratory notebook and of activities in the laboratory. These scores are incorporated into the overall laboratory report score. A satisfactory criterion will be a score of 75% or more on the appropriate portion of the lab report score sheet for 90% of the students. The Outcomes Criteria for objectives 3-5 and 7-8 will be based on evaluation of laboratory reports. A satisfactory criterion will be an overall score of 75% or above for 90% of the students.

The Outcomes Criteria for objective 9 will be based on evaluation of student presentations, scored for quality of literature search, discussion of relevant chemistry, organization, and presentation to the class. A satisfactory criterion will be an overall score of 75% or above for 90% of the students.

Goals and Objectives for Chem 4161 and 4162 Advanced Inorganic Chemistry

The purpose of this course sequence is to equip students with a working knowledge of the basic concepts and electronic properties of the chemical elements in order to describe and explain the chemical properties and reactivities of the elements in the periodic table. The topics covered are determined by guidelines established by the American Chemical Society and exhibited in the widely used textbooks in U.S. universities. The topics emphasized include:

1. Atomic structure - the basis for the periodic arrangement of the elements. Students are expected to learn how to explain the structure of the periodic table and the chemical properties of the elements in terms of the quantum theory of electrons and to use this knowledge to explain and predict chemical and physical properties of the elements. They are also expected to learn how to describe states of atoms in spectroscopic term symbols.

2. Molecular models – Students are expected to learn how to predict the formulas and geometries of small molecules and to use mathematical group theory to classify molecular symmetry and understand a molecular orbital description of the molecular electronic states. Student are expected to learn how to use character tables and use symmetry labeling to carry out configuration interactions in creating molecular orbital diagrams of simple molecules.

3. Chemical reactions – Students are expected to learn the concepts used in modern chemistry to describe and understand the two important classifications of chemical reactions (1) acid/base and (2) oxidation/reduction. Concepts that should be learned include the important definitions of acids/bases including protonic and nonprotonic and solvent-based definitions. Students are also expected to learn how to use emf calculations to predict redox reactions in aqueous solutions.

4. Coordination Chemistry – Topics to be learned include nomenclature of coordination complexes, valence bond and ligand field theories of coordination compounds, assignments of ground and excited electronic states of transition metal complexes as well as spectral band assignments, the reaction mechanisms of ligand substitution reactions and the mechanisms of photochemical reactions for transition metal complexes.

5. Organometallic compounds - Students are expected to learn the most important types of metal- organic ligand complexes involving pi and sigma metal-carbon coordination bonding.

6. Chemistry of metal and nonmetal families in the periodic table – The important small inorganic compounds that are stable in the metal and non-metal families of elements are surveyed in order to gain a wide understanding of the compound types and periodic table trends. Students are expected to be able to explain formulas and properties in terms of the quantum theory of electronic structures learned in the beginning of the course.

The outcomes criteria are based on targeted questions in the mid term exams and final exams, as well as on graded homework problem sets designed to measure comprehension of the above learning objectives, and on class participation of the students in group discussion and at the blackboard. A passing grade requires at least a 70% comprehension estimation of the targeted questions.

Goals and Objectives of Chem 4180 - Advanced Inorganic Chemistry Laboratory

The objective of this laboratory course is to illustrate the chemical principles studied in Chem 4161,and 4162 and to practice using the theoretical tools learned in advanced inorganic chemistry by synthesizing inorganic and organometallic compounds, measuring their chemical and spectroscopic properties, and discussing the results in formal laboratory reports. In the process the students are expected to learn how to synthesize inorganic compounds, learn how to use an array of instruments including the GC Mass Spec, magnetic susceptibility balance, diode array UV and visible spectrophotometer, and FT-IR. In the process they will practice using some of the basic laboratory procedures important to chemical research including refluxing, distillation, digestion, sublimation, filtration, reagent handling, safety procedures, micropipetting, and melting point measuring. They also are expected to learn how to search the chemical literature for ideas and corroboration of their results and explanations. They are also expected to learn how to write up their results as printed reports that include data and graphs in a style and format that would be acceptable to scientific review.

The outcome criteria are based on careful evaluation of laboratory technique, experiment results, and the laboratory reports. The reports will be returned for correction and rewriting if necessary.

Chemistry 4411 - General Biochemistry (4 units)

Students who successfully complete this course should:

1. understand buffer theory and the preparation of laboratory buffers.
2. know the structures and properties of the twenty amino acids.
3. know the unique properties and chemistry of the peptide bond.
4. recognize the common structural motifs found in proteins --including the alpha-helix, the beta-sheet, and other structural features.
5. know the properties of enzymes and the basics of enzyme kinetics--including the Michaelis-Menten equation, Lineweaver-Burke equation and graphs, and the basics of enzyme inhibition.

Chemistry 4412 - General Biochemistry (4 units)

Students who successfully complete this course should:

1. understand the basic principles of bioenergetics --including standard and actual free energy changes and the calculation of these energy changes in biochemical reactions.
2. understand the unique chemistry of Adenosine Triphosphate (ATP) -- including standard and actual free energy change values for ATP hydrolysis.
3. know the structure and properties of biologically-important carbohydrates.
4. understand the basic details of the major metabolic pathways found in the cell --including glycolysis, gluconeogenesis, glycogen metabolism, the citric acid cycle, electron transport system, oxidative phosphorylation, and fatty acid oxidation.

Chemistry 4413 -General Biochemistry (4 units)

Students who successfully complete this course should:

1. know the basics of protein and amino acid metabolism -- including amino acid catabolism and anabolism and the urea cycle.
2. know the structure and properties of the purine and pyrimidine nucleotides.
3. know the structural details of the DNA molecule and how it is able to replicate.
4. know the structural details of the RNA molecule and how RNA synthesis and processing occurs in the cell.
5. know how proteins are synthesized in the cell using ribosomes, tRNA, and mRNA.

Chemistry 4430 - General Biochemistry Laboratory, (4 units)

Students who successfully complete this course should:

1. know buffer theory and how to prepare a laboratory buffer.
2. know how to perform protein and enzyme activity assays and how to calculate results from laboratory-derived data.
3. know how to calculate data commonly found in Protein Purification Tables and how to interpret this information.
4. know how to perform enzyme kinetic data analysis and how to present this data in graphical format.
5. know theory and practical details of chromatographic procedures --including gel filtration chromatography, ion-exchange chromatography, and high performance liquid chromatography (HPLC) .
6. know the theory and practical details of electrophoresis of proteins and DNA.
7. know how to develop a well-written laboratory notebook.

Chemistry 4431- Advanced Biochemistry Laboratory (2 units)

Students who successfully complete this course should:

1. know how to isolate and quantitate plasmid DNA.
2. understand the theoretical basis for the Polymerase Chain Reaction (PCR) technique and know the important methodologies for cloning PCR products.
3. amplify various segments of a DNA molecule using PCR.
4. analyze the DNA products of a PCR experiment for size and purity using agarose gel electrophoresis.
5. clone PCR fragments into an expression vector and transform the resulting chimeric DNA into *E. coli* cells.
6. know the theoretical basis for and practical details of performing a Western Blot using SDS-PAGE, electroblotting, and detection with primary antibody and enzyme-conjugated secondary antibody.

Outcomes Criteria for Chemistry 4430 and 4431- Biochemistry Laboratory Courses

Specific questions will be embedded into regular course exams/quizzes. These questions will be either multiple-choice, short-answer/essay, or problem-solving questions. The specific embedded questions will assess the theoretical/procedural/ analytical Goals and Objectives of each course. Exams completed by Chemistry or Biochemistry majors will be identified, and the responses to the embedded questions will be tallied and recorded. A specific objective will be considered to be achieved if 70% of the students correctly answer the embedded question(s) pertinent to that objective.

Chemistry 4440 - Protein Structure (3 units)

Students who successfully complete this course should:

1. know the structures and properties of the twenty amino acids.
2. know the unique chemistry and properties of the peptide bond and understand the other bonding forces holding proteins together.
3. know how the primary, secondary, and tertiary structural features of proteins are determined.
4. know the unique structural details commonly found in proteins --including the alpha-helix, the beta-sheet, the loop-helix-loop motif, the "Greek Key" motif, and the hairpin motif, among others.
5. know and understand the unique folding patterns found in specific classes of proteins -- including alpha-domain folding patterns, beta-sheet folding pattern, and alpha/beta-folding pattern.
6. know how proteins fold into complex 3-D structures.
7. know about the unique 3-D of specific classes of proteins including enzymes, antibodies, virus coat proteins, and DNA-binding proteins.

Chemistry 4450- Nucleic Acid Chemistry (3 units)

Students who successfully complete this course should:

1. understand the various types of sequence elements that make up genes, gene-

related sequences, and extragenic elements in prokaryotic and eukaryotic genomes.
2. understand promoter structure and mechanisms for regulating transcription through repressors, activators, general and specific transcription factors, enhancers, silencers, external signaling compounds, and alteration of nucleosome structure.
3. know the basics of gene cloning and have a general knowledge of vectors and library construction.
4. understand DNA sequencing technology, assembly of contiguous sequences and the use of sequence differences among individuals for DNA fingerprinting.
5. be able to navigate the national and international genome databases on the web and use the BLAST program to search for homologues of specific cDNAs.

Chemistry 4460 - Major Organ Biochemistry (3 units)

Students who successfully complete this course should be able to:
1. understand the basic anatomy of the major organs of the body -- including skeletal muscle, heart, brain, liver, adipose tissue, kidney, and bone tissue.
2. understand the unique cell stuctures found in the major organs of the body -- including skeletal muscle, heart, brain, liver, adipose tissue, kidney, and bone tissue.
3. understand the biochemistry unique to the major organs of the body -- including skeletal muscle, heart, brain, liver, adipose tissue, kidney, and bone tissue.

Outcomes Criteria for Chemistry 4411, 4412, 4413, 4440, 4450, and 4460:

Specific questions will be embedded into regular course midterm exams and final exams. These questions will be multiple choice, short answer/essay, or problem solving questions. The specific embedded questions will assess each of the Goals and Objectives enumerated for each course.

Exams completed by Chemistry or Biochemistry majors will be identified, and the responses to the embedded questions will be tallied and recorded. A specific objective will be considered to be achieved if 70% of the students correctly answer the embedded questions(s) pertinent to that objective.

Chemistry 4601, 4602 Environmental Chemistry Lecture and Laboratory

Students who successfully complete this series of courses should be able to:

1. perform environmental analyses using procedures that include making a sample collection plan, collection of samples, making solutions, and using various types of laboratory and field equipment to test environmental samples.
2. keep a clear laboratory notebook in which they describe objectives and procedures, and tabulate data.
3. plot data to determine trends using linear fitting.
4. compare their experimental results with those from the literature.
5. write laboratory reports in the format of journal articles, including sections describing introduction, experimental, results and discussion, and conclusions.
6. perform calculations involving acid-base equilibria, multiple equilibria, reaction enthalpy, free energy, and first order decay.
7. understand how chemical pollutants can have complex effects on the environment.
8. understand the chemistry of water equilibria, ozone depletion, and the greenhouse effect.
9. participate in classroom discussions on environmental cleanup sites, ozone hole formation, and alternative energy.

The Outcomes Criteria for objectives 1-5 will be based on evaluation of the laboratory notebook, activities in the laboratory and scoring of written reports. As a capstone project in the second quarter they will perform laboratory research on a topic of their own choosing. This will involve planning, sample collection, sample processing and analysis, evaluation of data in the context of the literature, and presentation of that topic in a poster session. A satisfactory criterion will be a score of 75 % or more on the appropriate portions of the lab report score sheets and poster presentations for 90% of the students.

The Outcomes Criteria for objectives 6-9 will be based on examinations. A satisfactory criterion will be an overall score of 75% or above for 90% of the students. Examinations will include questions based on information students provide in classroom discussions.

Appendix B

Assessment of Learning Outcomes for Chemistry and Biochemistry Majors

A. Outcomes from the Organic Chemistry Lecture/Lab Series as an Indicator of Student Performance

Student Learning Outcomes – Organic Chemistry Lecture

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 our chemistry and biochemistry majors were compared with the national distribution and are reported as national percentiles in Figure 1.

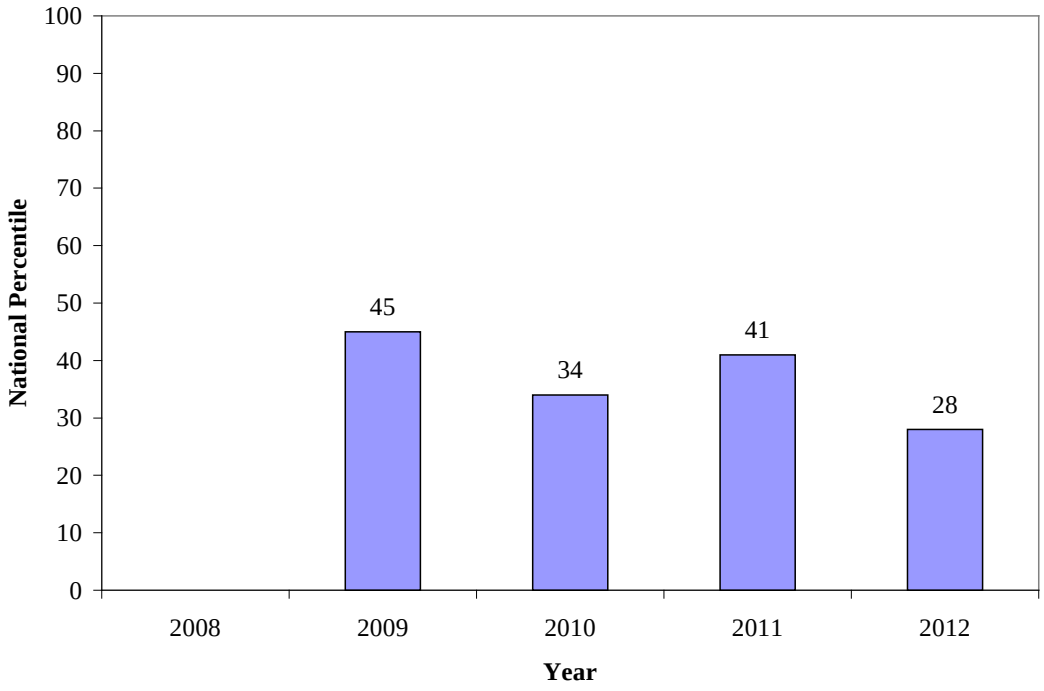


Figure 1. Standardized ACS Organic Chemistry Exam Results for Chemistry and Biochemistry Majors, 2008 – 2012. The number of majors who took the exam ranged from 17 – 26 over the four year period from 2009 through 2012. Note: In 2008, we beta tested a new exam so there were no national norms available.

Assessment Analysis

Over the last five years, the ACS Organic Exam results have been variable (see Figure 1). We are unable to account for the variability at this time. However, we are gratified that many of our majors do exceed the national average every year.

Student Learning Outcomes – Organic Chemistry Lab

To be able to carry out standard organic laboratory techniques, demonstrate knowledge of chemical reactivities, and obtain and interpret spectroscopic data

Assessment Method and Data

A capstone laboratory assignment to be accomplished over several periods served as the performance test. Students were 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 identified one or both of the chemical unknowns (see Table 1).

Table 1. Results of Capstone Organic Laboratory Assignment for 2008– 2012

Year	# of Chem/Biochem Majors	# with both correct	% Both Correct	# with at least one correct	% At least one correct
Sp 2008	10	7	70	9	90
Sp 2009	17	10	74	14	95
Sp 2010	25	12	48	21	84
Sp 2011	26	15	58	23	88
Sp 2012	25	13	52	21	84

Assessment Analysis

From 2008 through 2012, an overwhelming majority of majors were able to identify at least one of the chemical unknowns. This number, as well as the number of students able to identify both unknowns, however, has decreased. This decrease correlates to the increasing number of majors in our program being assessed. We are concerned by these results and plan to look closely at next years' results to determine if this decrease continues.

B. Student Performance in the Biochemistry Program: Assessment of the General Biochemistry Lecture Series and an Advanced Biochemistry Laboratory Course

Student Learning Outcomes – Lecture Topics

Learning objectives relating to major topics in the year-long General Biochemistry lecture series and the Advanced Biochemistry Laboratory course are outlined in the Program Assessment Plan. Randomly selected outcomes were assessed for the courses in the lecture series (CHEM 4411-4412-4413) and for lecture material from the laboratory course (CHEM 4431). These outcomes are listed in Table 2, along with the assessment results.

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% of the possible points were assigned. The assessment results are reported as the percentage of Biochemistry majors correctly answering each embedded question (see Table 2 on the next page). The number of students monitored ranged from 14 to 31 over the five year period, except in 2009-10 where the sample size for the values marked with an asterisk was only 4 or 5 students.

Assessment Analysis

For most of the topics, between 60 and 80 percent of the biochemistry majors mastered the designated outcomes, with an occasional lower or higher percent value obtained. For some topics the percentage of students able to answer the embedded questions was higher, between 70 and 80, whereas in other cases the values tended to hover between 60 and 70. This is probably attributable to the difficulty of the concept. The values marked with an asterisk for 2009-2010 were obtained with a small sample, just four or five students, and are therefore not very representative and should be discounted in our view.

The results for 2010-2011 are a little troubling, with not as much data available as for the other years and some very low values (23 and 29) obtained for two of the outcomes ("understanding the basic principles of bioenergetics" and "adenosine triphosphate chemistry"). These low values seem to be an anomaly since the instructor was the same for all five years, and the values for the previous and subsequent years are much higher and similar to one another. The instructor attributed the low values to a class in which many of the students had taken the prerequisite General Chemistry courses quite a while earlier and/or had taken them at a community college. The particular objectives for which low values were obtained rely heavily on background knowledge obtained in General Chemistry.

We conclude that our biochemistry majors are doing well, but there is room for improvement. As a general goal, we are aiming for percentages of correct answers above

75% for all the outcomes. A general scan of the data in Table 2 indicates we were not far from achieving this goal for all the outcomes for all years except 2010-2011. There was improvement as the years went by. In 2007-2008, the goal of 75% of the students mastering the outcome was achieved for only two of the ten objectives monitored; this improved to five of ten objectives in 2008-2009 and six of eleven objectives in 2011-2012. The data for 2009-2010 are not quite so good, although for the reliable samples the percentages are not too far from the goal of 75%. As discussed above, the results for 2010-2011 may be anomalous. We plan to continue our efforts to improve student learning using a variety of teaching tools such as clicker questions to monitor student understanding of concepts, occasional student discussion sessions during the lecture periods and the use of problems relevant to real life medical situations to illustrate biochemical principles.

Table 2. Assessment Results for Biochemistry Majors 2007-2012: Lecture Topics[a].

	% Students with correct answers to embedded questions				
Learning Outcome	2007-08	2008-09	2009-10	2010-11	2011-12
Master the structures + properties of amino acids	72	67	61	-	71
Recognize common structural motifs in proteins	72	79	73	-	77
Be able to distinguish the properties of enzymes	64	65	67	69	62
Understand basics of enzyme kinetics	68	76	73	74	79
Comprehend protein regulatory mechanisms	-	-	64	-	80
Learn the structures + properties of biologically important carbohydrates	76	59	81*	53	71
Understand the basic principles of bioenergetics	50	80	75*	23	81
Master the unique chemistry of adenosine triphosphate	61	80	13*	29	71
Understand the basic details of the major metabolic pathways	62	63	59*	51	83
Know DNA and RNA structure	83	76	81	71	80
Understand molecular basis for DNA Replication	70	72	73	-	70

[a]The number of students monitored ranged from 14 to 31, except in 2009-10 where the sample size for the values marked with an asterisk was only 4 or 5 students.

Student Learning Outcome – Laboratory Analytical Skills

To correctly analyze the data for a multipart experiment designed to localize an RNA initiation site on *E. coli* DNA; to interpret the results and define the site.

Several of the laboratory-based learning outcomes for the Advanced Biochemistry Laboratory course were incorporated into a five week experiment designed to localize an RNA initiation site on *E. coli* DNA. In addition to mastering the laboratory skills described in the learning objectives, the students were asked to correctly interpret their results and define the location of the RNA initiation site. They were also required to analyze imaginary data that led to a different conclusion. The goal was to assess the ability of the students to critically analyze data in their field of study.

Assessment Method and Data

Assessment was based on a combination of the scores on a multi-part essay question asked each year and the quality of the data analysis in the laboratory notebook the students turned in (except in 2010, when the analysis was not performed). The results for the exam question were the primary assessment tool, with the answers scored as correct when 75% of the possible points were assigned. However, if the quality of the

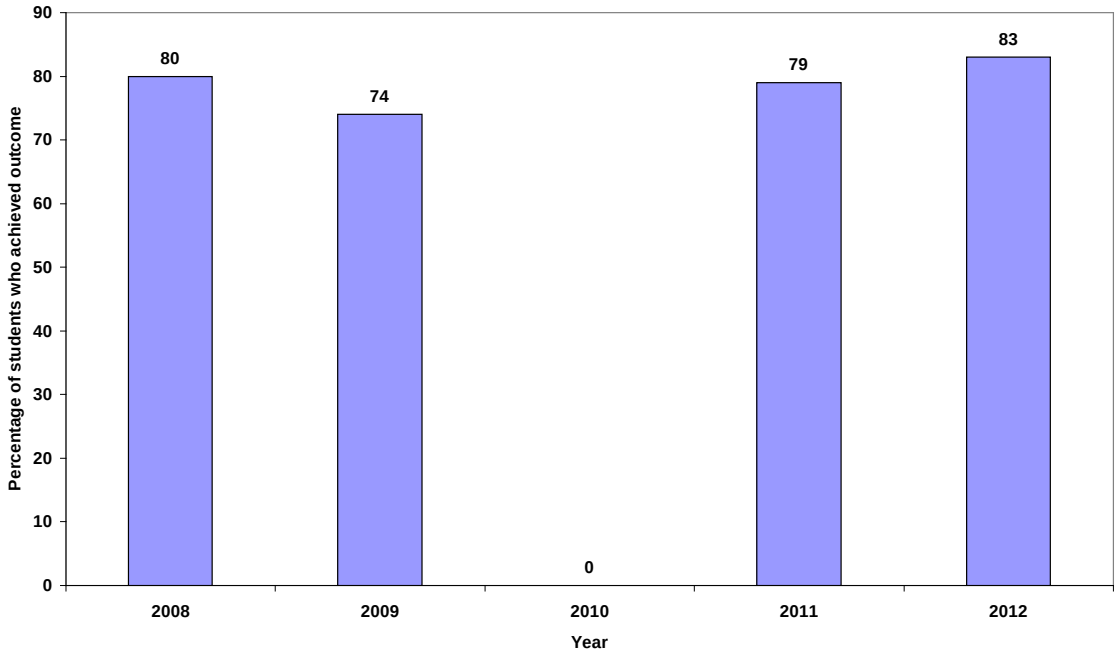


Figure 2. Assessment of Laboratory Analytical Skills for Biochemistry Majors in the Advanced Biochemistry Laboratory Course, 2008–2012. The number of students ranged from 25 to 35 over the four year period. The analysis was not performed in 2010.

data analysis in the laboratory notebook clearly indicated that the student had mastered the objective, he or she was scored as having achieved the outcome even if the exam question was not scored as correct. In general the exam question and notebook analysis matched, but there were a few cases where the notebook analysis was used to rate a student as having mastered the outcome. Figure 2 summarizes the results obtained for year 2008 through 2012.

Assessment Analysis

The results obtained were quite encouraging, with roughly 80% of the students demonstrating the desired laboratory analytical skills each year the assessment was done. In earlier years, it had been observed that the student majors did not always fully understand the significance of the results they obtained in the laboratory experiments. To remedy that situation, more teaching time is now devoted to data analysis. Sample data is provided by the instructor for class discussions, and the analysis is broken down into a series of questions that lead to appropriate conclusions. Students are encouraged to participate in class discussions but also to work in smaller groups for analysis of data contributed individually but shared by the whole class in reaching the experimental conclusions. Over this review period that strategy appeared to work, although it would of course be ideal if 100% of the students achieved the outcome, and we will continue to work toward this goal.

C. Outcomes from the Physical Chemistry Lecture Series

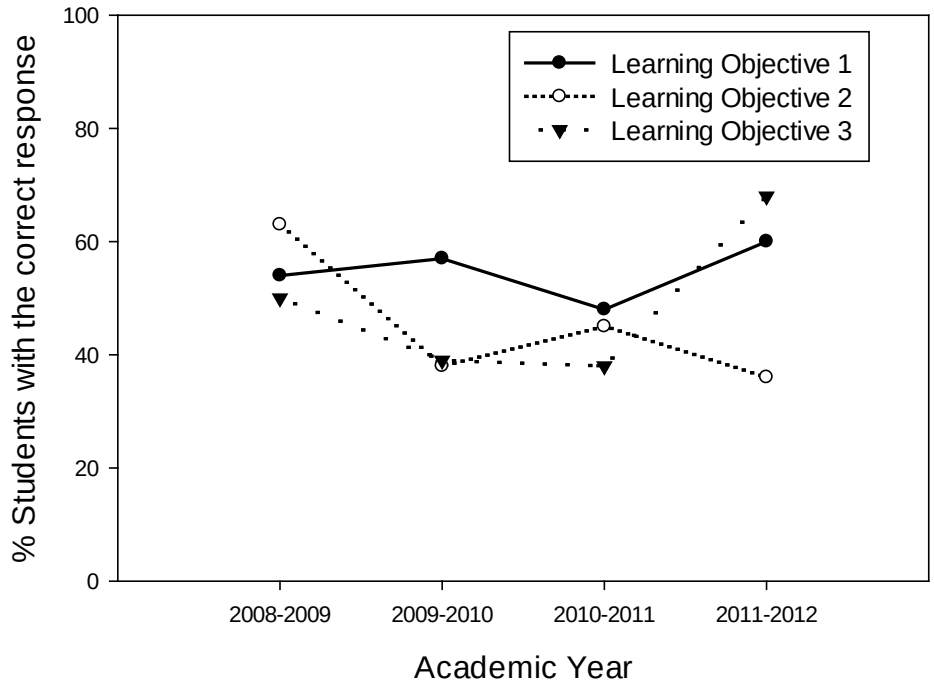
CHEM 3511 Learning objective 1: To be able to explain why the internal energy of an ideal gas is a function only of temperature.

CHEM 3512 Learning objective 2: To be able to determine the force constant and bond length given a molecules' vibrational and rotational energy in wavenumbers.

CHEM 3513 Learning objective 3: To identify the molecular point group of a molecule.

Academic Year	**% Students with correct answers to embedded questions**		
	Learning Objective 1	Learning Objective 2	Learning Objective 3
2008-2009	54	63	50
2009-2010	48	38	39
2010-2011	60	45	38
2011-2012	57	36	68

The graph below reflects the correct response over the last five years for each learning objective. There is no obvious trend to the data, but the data does reflect that the students' abilities to correctly meet the learning objective are relatively constant from year-to-year.



Appendix C

Assessment of General Education Courses Offered by the Chemistry & Biochemistry Department

Student Learning Outcomes for Upper Division General Education Courses

1. Students will demonstrate advanced and/or focused science content knowledge in a specific scientific field using appropriate vocabulary and referencing appropriate concepts (such as models, uncertainties, hypotheses, theories, and technologies).
2. Students will apply advanced quantitative skills (such as statistics, algebraic solutions, interpretation of graphical data) to scientific problems.
3. Students demonstrate understanding of the nature of science and scientific inquiry and the experimental and empirical methodologies utilized in science to investigate a scientific question or issue.
4. Students will critically analyze scientific claims and data.
5. Students will apply science content knowledge to contemporary scientific issues (e.g. global warming) and technologies (e.g. cloning), where appropriate.

Assessment Method

A pre-test and isomorphic post-test (as the final exam) were administered through the Mastering Chemistry website provided by the publisher of the textbook for the course.

CHEM 3011, Foundational Chemistry

Assessment Results:

In Fall 2011, 22 students took the pre-assessment test. The average was 57%. At the end of the course, 25 students took the post-assessment test. The average improved to 88%. The results are displayed in Table 1.

Table 1. Pre-Assessment and Post-Assessment Results for Fall 2011

Pre-Assessment Results		**Post-Assessment Results**	
% Average	**# of Students**	**% Average**	**# of Students**
< 50 %	7	< 50 %	1
50 – 70 %	9	50 – 70 %	1
70 – 85 %	5	70 – 85 %	1
85 – 100 %	1	85 – 100 %	22

Students were evaluated on their ability to do the following:
Convert units, including when raised to a power.
Classify matter.
Demonstrate an understanding of physical and chemical properties.

Demonstrate an understanding of physical and chemical changes.
Calculate energy, temperature change, and heat capacity.
Determine the number of protons and electrons in an ion.
Determine atomic numbers, mass numbers, and isotope symbols for an isotope.
Demonstrate an understanding of periodic trends: atomic size, ionization energy, and metallic character.
Write formulas for ionic compounds.
Identify a chemical reaction.
Write balanced chemical equations.
Write Lewis structures for covalent compounds.
Predict the shapes of molecules.
Use heat of vaporization and heat of fusion in calculations.
Name alkanes, alkenes, alkynes, and aromatic compounds.

Assessment Analysis
Significant content gains occurred over the period of the course.

Appendix D

B.S. Chemistry Degree Program Requirements

Courses	CSU East Bay quarter	CSU Sacramento semester (quarter)	CSU Los Angeles quarter	CSU Northridge semester (quarter)	San Jose State semester (quarter)	UC Santa Barbara quarter
General Chem	15	10 (15)	15	10 (15)	10 (15)	15
Calculus	16	12 (18)	20	16 (24)	10 (15)	20
Physics	15	12 (18)	19	10 (15)	12 (18)	16
Organic	15	12 (18)	15	13 (19.5)	10 (15)	21
Quantitative Analysis	5	4 (6)	5	4 (6)	4 (6)	3
Physical Chem	9	6 (9)	12	8 (12)	6 (9)	12
Physical Chem Lab	4	3 (4.5)	4	2 (3)	2 (3)	3
Inorg. Chem	6	3 (4.5)	6	3 (4.5)	3 (4.5)	6
Inorg. Chem Lab	2	2 (3)	-	1 (1.5)	2 (3)	3
Biochem	4	3 (4.5)	4	4 (6)	4 (6)	3
Instrumental Analysis	4	4 (6)	6	4 (6)	4 (6)	3
Computer	4	-	-	-	3 (4.5)	-
Writing for Chem	-	-	4	-	3 (4.5)	-
Science Ethics	-	-	-	-	3 (4.5)	-
Physical-Inorg Lab	-	-	-	-	3 (4.5)	-
Safety	-	-	-	-	1 (1.5)	-
Senior Research	-	-	-	1 (1.5)	-	-
Electives	12	6 (9)	7	3 (4.5)	6 (9)	12

Note: CSU Sacramento, Northridge, and San Jose State are on the semester system. The equivalent quarter units are shown in parentheses.

B.A. Chemistry Degree Program Requirements

Courses	CSU East Bay quarter	CSU Sacramento semester (quarter)	CSU Los Angeles quarter	CSU Northridge semester (quarter)	San Jose State semester (quarter)	UC Santa Barbara quarter
General Chem	15	10 (15)	15	10 (15)	10 (15)	15
Calculus	8	12 (18)	12	6 (9)	4 (6)	16
Physics	12	8 (12)	12	8 (12)	8 (12)	12
Organic	15	9 (13.5)	13	10 (15)	10 (15)	18
Quantitative Analysis	5	4 (6)	5	4 (6)	4 (6)	3
Physical Chem	4	6 (9)	4	4 (6)	4 (6)	12
Physical Chem Lab	-	3 (4.5)	-	1 (1.5)	-	3
Inorg. Chem	-	-	-	3 (4.5)	-	3
Biochem	4	-	4	-	-	-
Bioanalytical Lab	4	-	4	-	-	-
Instrumental Analysis	-	-	-	4 (6)	-	3
Computer	-	-	-	-	-	-
Writing for Chem	-	-	4	-	3 (4.5)	-
Science Ethics	-	-	-	-	3 (4.5)	-
Chem Literature	2	-	-	-	-	-
Safety	-	-	-	-	1 (1.5)	-
Senior Research	-	-	-	1 (1.5)	-	-
Electives	11	12 (18)	-	7 (10.5)	19 (28.5)	3

Note: CSU Sacramento, Northridge, and San Jose State are on the semester system. The equivalent quarter units are shown in parentheses.

B.S. Biochemistry Degree Program Requirements

Courses	CSU East Bay quarter	CSU Los Angeles quarter	CSU Northridge semester (quarter)	CSU Sacramento semester (quarter)	San Jose State semester (quarter)	UC Santa Barbara quarter
General Chem	15	15	10 (15)	10 (15)	10 (15)	15
Calculus	12	16	6 (9)	8 (12)	10 (15)	16
Physics	12	15	8 (12)	8 (12)	12 (18)	12
Organic	15	13	10 (15)	12 (18)	10 (15)	18
Quantitative Analysis	5	5	4 (6)	4 (6)	4 (6)	-
Biology	15	10	8 (12)	12 (21)	12 (18)	11
Statistics	4	-	-	-	-	-
Physical Chem	9	8	8 (12)	4 (6)	6 (9)	12
Physical Chem Lab	-	-		3 (4.5)	-	-
Inorg. Chem	-	3	3 (4.5)	-	-	3
Biochem	12	12	9 (13.5)	6 (9)	11 (16.5)	9
Biochem Lab	6	4	2 (3)	6 (9)	5 (7.5)	11
Instrumental Analysis	-	-	4 (6)	-	-	-
Cell Biol.	-	-	3 (4.5)	-	-	-
Computer	4	-	-	-	-	-
Writing for Chem	-	4	-	-	-	-
Science Ethics	-	-	-	-	3 (4.5)	-
Safety	-	-	-	-	1 (1.5)	-
Senior Research	-	-	-	-	-	-
Electives	6	12	9 (13.5)	6 (9)	3 (4.5)	11

Notes: CSU Fullerton, Northridge, and San Jose State are on the semester system. The equivalent quarter units are shown in parentheses.

B.A. Biochemistry Degree Program Requirements

Courses	CSU East Bay quarter	CSU Sacramento semester (quarter)
General Chem	15	10 (15)
Calculus	8	8 (12)
Physics	12	8 (12)
Organic	15	9 (13.5)
Quantitative Analysis	-	4 (6)
Biology	15	10 (15)
Physical Chem	4	4 (6)
Biochem	12	6 (9)
Biochem Lab	6	6 (9)
Computer	4	-
Electives	3	6 (9)

Notes: CSU Sacramento is on the semester system. The equivalent quarter units are shown in parentheses.

The degree at CSU Sacramento is a B.A. in chemistry with a concentration in Biochemistry. CSU Los Angeles, Northridge, and San Jose State do not have a B.A. Biochemistry program or B.A. Chemistry with a biochemistry option or concentration.

B.S. Chemistry Degree with an Option in Forensic Science Program Requirements

Courses	CSU East Bay quarter	CSU Sacramento semester (quarter)
General Chem	15	10 (15)
Calculus	12	8 (12)
Physics	12	8 (12)
Organic	15	12 (18)
Quantitative Analysis	5	4 (6)
Biology	15	-
Statistics	4	-
Physical Chem	6	4 (6)
Biochem	4	3 (4.5)
Biochem Lab	-	3 (4.5)
Bioanalytical Lab	4	-
Instrumental Analysis	4	-
Genetics	5	-
Criminal Invest.	4	3 (4.5)
Comparative Evidence	4	3 (4.5)
DNA Sequencing Anal.	4	-
Forensic Seminar	3	-
Electives	3	6 (9)

Notes: CSU Sacramento is are on the semester system. The equivalent quarter units are shown in parentheses.

This degree at CSU Sacramento is a B.A. in chemistry with a concentration in Forensic Science.

B.A. Chemistry with an Option in Chemistry Education Program Requirements

Courses	CSU East Bay quarter	San Jose State quarter (semester)
General Chem	15	10 (15)
Calculus	8	3 (4.5)
Geology	5	6 (9)
Computer	4	-
Physics	12	8 (12)
Quantitative Analysis	4	4 (6)
Organic	15	10 (15)
Physical Chem	4	4 (6)
Physical Chem Lab	-	4 (6)
Inorg. Chem	-	3 (4.5)
Biochem	4	4 (6)
Bioanalytical Lab	4	-
Instrumental Analysis	-	4 (6)
Instructional Activities	2	
Science Education	3	4 (6)
Writing for Chem	-	3 (4.5)
Science Ethics	4	3 (4.5)
Chem. Literature	2	-
Safety	-	1 (1.5)
Senior Research	-	-
Electives	-	9 (13.5)

Note: San Jose State is on the semester system. The equivalent quarter units are shown in parentheses.

M.S. Chemistry Degree Program Requirements

	CSU East Bay quarter	CSU Sacramento semester (quarter)	CSU Los Angeles quarter	CSU Northridge semester (quarter)	San Jose State semester (quarter)	UC Santa Barbara quarter
Core or Elective Course Units	33-37	20 (30)	26	21 (31.5)	24 (36)	24
Completion Units (Thesis, seminar, exam, etc.)	8-12	10 (15)	20	9 (13.5)	6 (9)	12
Total	45	30 (45)	46	30 (45)	30 (45)	36

Minor in Chemistry Requirements

Course Units	CSU East Bay quarter	CSU Sacramento semester (quarter)	CSU Northridge semester (quarter)	San Jose State semester (quarter)	UC Santa Barbara quarter
General Chem	15	10 (15)	10 (15)	10 (15)	15
Organic	15	6 (9)	8 (12)	-	-
Quantitative Analysis	5	4 (6)	4 (6)	-	-
Physical Chem	-	-	-	-	4
Instrumental Analysis	-	-	-	-	3
Physical, Biochem, or Environ Chem	4	-	3 (4.5)	-	-
Biochem Lab	-	-	1 (1.5)	-	-
Safety	-	-	-	1 (1.5)	-
Upper Div. Electives	-	6 (9)	-	12 (15)	16

Note: CSU Sacramento, Northridge, and San Jose State are on the semester system. The equivalent quarter units are shown in parentheses.

Appendix E

List of Course Offerings at CSUEB

Courses for Majors

1101, 1102, 1103 General Chemistry
2200 Quantitative Analysis
3200 Bioanalytical and Forensic Instrumentation
3301, 3302, 3303 Organic Chemistry
3400 Introductory Biochemistry
3501 Biophysical Chemistry
3511, 3512, 3513 Physical Chemistry
3531, 3532 Physical Chemistry Lab
4161, 4162 Inorganic Chemistry
4180 Inorganic Chemistry Lab
4240 Instrumental Methods of Analysis
4311 Advanced Organic Chemistry
4400 Instructional Activities in Chemistry
4411, 4412, 4413 General Biochemistry
4430, 4431 Biochemistry Laboratory
4440 Protein Structure
4450 Nucleic Acid Chemistry
4460 Major Organ Biochemistry
4521 Elements of Chemical Thermodynamics
4601, 4602 Environmental Chemistry
4700 Survey of the Chemical Literature
4830 Seminar in Forensic Research
4810 Undergraduate Research
4811 Senior Thesis

Graduate Courses

6310 Advanced Topics in Organic Chemistry
6410 Advanced Topics in Biochemistry
6510 Advanced Topics in Physical Chemistry
6430 Protein Chemistry Techniques
6521 The Chemical Bond

Courses for Non-Majors

1000 Popular Topics in Chemistry
1100 Introduction to College Chemistry
1601, 1602 Basic Chemistry for the Health Sciences
2301, 2302 Survey of Organic Chemistry
3010 The Making of Wine
3011 Foundational Chemistry
3012 Foundational Chemistry Laboratory

Appendix F

Data in Appendix F was obtained from the Academic Performance Review Statistics available from Institutional Research and Assessment (http://www.csueastbay.edu/ira/).

Number of undergraduate and graduate majors enrolled

Degree	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011
Biochemistry Bachelor	84	80	92	88	104
Biochemistry PostBaccalaureate	6	5	6	4	2
Chemistry Bachelor	56	66	56	62	76
Chemistry PostBaccalaureate	3	4	6	4	0
Total Undergraduate	**149**	**155**	**160**	**158**	**182**
Chemistry Graduate	47	57	43	44	54
Total Enrolled	**196**	**212**	**203**	**202**	**236**

Number of degrees awarded for the past five years

Degree	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Biochemistry Undergraduate	22	20	18	23	25
Chemistry Undergraduate	7	8	4	7	9
Total Undergraduate	**29**	**28**	**22**	**30**	**34**
Chemistry Graduate	7	12	15	13	10
Total Degrees	**36**	**40**	**37**	**43**	**44**

Ethnicity of Chemistry Baccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	24	42.9	22	33.3	17	30.4	20	32.3	21	27.6
Black	4	7.1	8	12.1	9	16.1	3	4.8	4	5.3
Hispanic	6	10.7	6	9.1	11	19.6	15	24.2	18	23.7
Pacific Islander	-	0	4	6.1	2	3.6	-	0	-	0
White	14	25.0	14	21.2	10	17.9	14	22.6	13	17.1
Multiple Ethnicity	-	0	-	0	-	0	4	6.5	3	3.9
Unknown	6	10.7	8	12.1	6	10.7	2	3.1	11	14.5
Nonresident alien	2	3.6	4	6.1	1	1.7	4	6.5	6	7.9
Total	56	100	66	100	56	100	62	100	76	100

Ethnicity of Chemistry PostBaccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	-
Asian	2	66.7	2	50.0	1	16.7	2	50.0	-	-
Black	1	33.3	-	0	-	0	-	0	-	-
Hispanic	-	0	1	25.0	2	33.3	1	25.0	-	-
Pacific Islander	-	0	-	0	-	0	-	0	-	-
White	-	0	-	0	1	16.7	-	0	-	-
Multiple Ethnicity	-	0	-	0	-	0	-	0	-	-
Unknown	-	0	1	25.0	2	33.3	1	25.0	-	-
Nonresident alien	-	0	-	0	-	0	-	0	-	-
Total	3	100	4	100	6	100	4	100	-	-

Ethnicity of Chemistry B.S. and B.A. Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	1	14.3	3	37.5	1	25.0	1	14.3	4	44.4
Black	1	14.3	-	0	-	0	-	0	-	0
Hispanic	1	14.3	-	0	-	0	2	28.6	1	11.2
Pacific Islander	-	0	-	0	-	0	-	0	-	0
White	4	57.1	1	12.5	3	75.0	3	42.8	2	22.2
Multiple Ethnicity	-	0	-	0	-	0	-	0	-	0
Unknown	-	0	3	37.5	-	0	1	14.3	-	0
Nonresident alien	-	0	1	12.5	-	0	-	0	2	22.2
Total	7	100	8	100	4	100	7	100	9	100

Ethnicity of Biochemistry Baccalaureate Students Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	41	48.8	40	50.0	43	46.8	39	44.3	41	39.4
Black	8	9.5	7	8.8	9	9.8	10	11.4	12	11.5
Hispanic	12	14.3	7	8.8	9	9.8	11	12.5	11	10.6
Pacific Islander	1	1.2	2	2.5	-	0	-	0	-	0
White	9	10.7	6	7.5	5	5.4	9	10.2	10	9.6
Multiple Ethnicity	-	0	-	0	-	0	4	4.5	2	1.9
Unknown	10	11.9	14	17.4	19	20.6	9	10.2	21	20.2
Nonresident alien	3	3.6	4	5.0	7	7.6	6	6.9	7	6.8
Total	84	100	80	100	92	100	88	100	104	100

Ethnicity of Biochemistry PostBaccalaureate Students Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	2	33.3	3	60.0	1	16.7	1	25.0	1	50.0
Black	1	16.7	1	20.0	3	50.0	1	25.0	-	0
Hispanic	2	33.3	-	0	-	0	-	0	-	0
Pacific Islander	-	0	-	0	-	0	-	0	-	0
White	1	16.7	1	20.0	-	0	1	25.0	-	0
Multiple Ethnicity	-	0	-	0	-	0	-	0	-	0
Unknown	-	0	-	0	2	33.3	1	25.0	1	50.0
Nonresident alien	-	0	-	0	-	0	-	0	-	0
Total	6	100	5	100	6	100	4	100	2	100

Ethnicity of Biochemistry B.S and B.A Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	12	54.5	6	30.0	8	44.4	10	43.5	12	48.0
Black	2	9.1	3	15.0	1	5.6	2	8.7	3	12.0
Hispanic	2	9.1	3	15.0	2	11.1	4	17.4	2	8.0
Pacific Islander	-	0	-	0	-	0	-	0	-	0
White	3	13.6	3	15.0	-	0	2	8.7	1	4.0
Multiple Ethnicity	-	-	-	-	-	-	-	-	-	-
Unknown	2	9.1	4	20.0	6	33.3	3	13.0	5	20.0
Nonresident Alien	1	4.6	1	5.0	1	5.6	2	8.7	1	4.0
Total	22	100	20	100	18	100	23	100	25	100

Gender of Chemistry Baccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	31	55.4	32	48.5	34	60.7	35	56.5	40	52.6
Male	25	44.6	34	51.5	22	39.3	27	43.5	36	47.4
Total	56	100	66	100	56	100	62	100	76	100

Gender of Chemistry PostBaccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	3	100	3	75.0	4	66.7	2	50.0	-	-
Male	0	0	1	25.0	2	33.3	2	50.0	-	-
Total	3	100	4	100	6	100	4	100	-	-

Gender of Chemistry B.S. and B.A. Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	4	57.1	3	37.5	3	75.0	5	71.4	5	55.6
Male	3	42.9	5	62.5	1	25.0	2	28.6	4	44.4
Total	7	100	8	100	4	100	7	100	9	100

Gender of Biochemistry Baccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	46	54.8	40	50.0	57	61.9	59	67.0	62	59.6
Male	38	45.2	40	50.0	35	38.1	29	33.0	42	40.4
Total	84	100	80	100	92	100	88	100	104	100

Gender of Biochemistry PostBaccalaureate Majors Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	3	50.0	3	60.0	2	33.3	1	25.0	-	0
Male	3	50.0	2	40.0	4	66.7	3	75.0	2	100
Total	6	100	5	100	6	100	4	100	2	100

Gender of Biochemistry B.S. and B.A. Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	12	54.5	10	50.0	8	44.4	15	65.2	14	56.0
Male	10	45.5	10	50.0	10	55.6	8	34.8	11	44.0
Total	22	100	20	100	18	100	23	100	25	100

Ethnicity of Chemistry M.S. Students Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	22	46.8	25	43.8	15	34.9	16	36.4	18	33.3
Black	1	2.1	1	1.8	2	4.7	2	4.5	3	5.6
Hispanic	-	0	3	5.3	3	7.0	2	4.5	3	5.6
Pacific Islander	2	4.3	3	5.3	1	2.3	-	0	-	0
White	5	10.6	5	8.8	4	9.3	7	15.9	9	16.7
Multiple Ethnicity	-	0	-	0	-	0	-	0	-	0
Unknown	8	17.0	7	12.3	7	16.2	7	15.9	6	11.1
Nonresident alien	9	19.2	13	22.7	11	25.6	10	22.8	15	27.7
Total	47	100	57	100	43	100	44	100	54	100

Ethnicity of Chemistry M.S. Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	3	42.9	9	75.0	3	20.0	4	30.8	3	30.0
Black	-	0	-	0	-	0	1	7.8	-	0
Hispanic	1	14.3	-	0	-	0	-	0	-	0
Pacific Islander	-	0	-	0	1	6.7	-	0	1	10.0
White	-	0	1	8.3	2	13.3	2	15.4	2	20.0
Multiple Ethnicity	-	-	-	-	-	-	-	-	-	-
Unknown	2	28.5	2	16.7	6	40.0	3	23.0	1	10.0
Nonresident alien	1	14.3	-	0	3	20.0	3	23.0	3	30.0
Total	7	100	12	100	15	100	13	100	10	100

Gender of Chemistry M.S. Students Enrolled

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	30	63.8	36	63.2	18	41.9	18	40.9	33	61.1
Male	17	36.2	21	36.8	25	58.1	26	59.1	21	38.9
Total	47	100	57	100	43	100	44	100	54	100

Gender of Chemistry M.S. Graduates

	2007-2008		2008-2009		2009-2010		2010-2011		2011-2012	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	5	71.4	5	41.7	10	66.7	9	69.2	5	50.0
Male	2	28.6	7	58.3	5	33.3	4	30.8	5	50.0
Total	7	100	12	100	15	100	13	100	10	100

Full Time/Part Time Status for Undergraduate Majors in Fall 2009[a]

	Bachelor				PostBaccalaureate			
	Full-time		Part-time		Full-time		Part-time	
	No.	%	No.	%	No.	%	No.	%
Biochemistry	**86**	**93.5**	**6**	**6.5**	**5**	**83.3**	**1**	**16.7**
Chemistry	**52**	**92.9**	**4**	**7.1**	**6**	**100**	**0**	**0**
Total	**138**	**93.2**	**10**	**6.8**	**11**	**91.7**	**1**	**8.3**

Full Time/Part Time Status for M.S. Students in Fall 2009[a]

Full-time		Part-time	
No. of students	**%**	**No. of students**	**%**
23	53.5	20	26.5

a. Only data on full-time/part-time status for 2009 was available from the Planning and Institutional Research web site.

Number of Faculty

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Full-Time Tenured/ Tenure-Track	7	100	8	100	8	100	7	100	7	100
Part-Time Tenured/ Tenure-Track	0	0	0	0	0	0	0	0	0	0
Total Tenured/ Tenure-Track	**7**	**100**	**8**	**100**	**8**	**100**	**7**	**100**	**7**	**100**

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Full-Time Lecturer	0	0	0	0	0	0	0	0	0	0
Part-Time Lecturer	10	100	12	100	12	100	6	100	12	100
Total Lecturer	**10**	**100**	**12**	**100**	**12**	**100**	**6**	**100**	**12**	**100**

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Total Tenured/ Tenure-Track	7	41.2	8	40.0	8	40.0	7	53.8	7	36.8
Total Lecturer	10	58.8	12	60.0	12	60.0	6	46.2	12	63.2
Total All Faculty	**17**	**100**	**20**	**100**	**20**	**100**	**13**	**100**	**19**	**100**

Ethnicity of Tenured/Tenure-Track Faculty

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
American Indian	-	0	-	0	-	0	-	0	-	0
Asian	1	14.3	1	12.5	1	12.5	1	14.3	1	14.3
Black	-	0	-	0	-	0	-	0	-	0
Hispanic	-	0	-	0	-	0	-	0	-	0
Pacific Islander	-	0	-	0	-	0	-	0	-	0
White	6	85.7	7	87.5	7	87.5	6	85.7	6	85.7
Multiple Ethnicity	-	0	-	0	-	0	-	0	-	0
Unknown	-	0	-	0	-	0	-	0	-	50.0
Total	7	100	8	100	8	100	7	100	7	100

Gender of Tenured/Tenure-Track Faculty

	Fall 2007		Fall 2008		Fall 2009		Fall 2010		Fall 2011	
	No.	%	No.	%	No.	%	No.	%	No.	%
Female	5	71.4	5	62.5	5	62.5	4	57.1	4	57.1
Male	2	28.6	3	37.5	3	37.5	3	42.9	3	42.9
Total	7	100	8	100	8	100	7	100	7	100

Instructional FTE Faculty (FTEF)

	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011
Tenured/ Tenure-track FTEF	6.4	5.0	6.3	5.6	6.3
Lecturers FTEF	8.1	9.4	6.6	6.2	7.4
Total Instructional FTEF	14.4	14.3	12.9	11.8	13.6

Total FTES Taught

	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011
FTES	257.0	280.8	292.7	269.0	302.2

Student Faculty Ratios (SFR)

	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011
Tenured/ Tenure-Track SFR	21.3	23.3	24.1	28.3	26.7
Lecturers SFR	15.1	17.6	21.2	18.0	18.3
Lower Division SFR	20.4	23.6	26.3	26.8	22.1
Upper Division SFR	18.4	18.7	19.5	23.0	23.6
Graduate SFR	5.4	6.0	11.2	7.0	14.9
SFR (all courses, all faculty)	17.8	19.6	22.6	22.9	22.2

Section Size

	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011
Number of Course Sections Offered	80	82	79	63	71
Average Section Size for All Courses	26.2	26.7	30.8	33.7	32.5
Lower Division Average Section Size	29.6	29.1	33.8	36.6	32.7
Upper Division Average Section Size	23.7	23.9	25.2	32.5	32.4
Graduate Average Section Size	12.3	14.0	26.0	15.3	27.5
Lower Division Sections Taught by Tenure-Track Faculty	3	3	10	4	10
Upper Division Sections Taught by Tenure-Track Faculty	25	12	20	14	15
Graduate Sections Taught by Tenure-Track Faculty	19	22	16	16	14
Lower Division Sections Taught by Lecturers	25	35	28	23	25
Upper Division Sections Taught by Lecturers	7	10	6	6	6
Graduate Sections Taught by Lecturers	1	1	0	0	1

Appendix G

M.S. Program in Chemistry: Plan A

	FALL	WINTER	SPRING
First Year	CHEM 4521 Elem Chem Thermo (4)[a,b] CHEM 6310 Adv Topics Org Chem (3)[c,g] CHEM 6820 Seminar (Audit)[e] Must satisfy Writing Skills requirement by examination or coursework Must take Placement Exams before classes begin and take remedial classes if necessary**	CHEM 6510 Adv Topics Phys Chem (3)[b,g] CHEM 6820 Seminar (1)[e] Elective* and/or Research[g]	CHEM 4700 Survey Chem Literature (2)[d] CHEM 6521 The Chemical Bond (3)[b] CHEM 6820 Seminar (1)[e] Elective*, Advanced Topics[g] or Research[h,i]
Second Year	CHEM 6830 Research(1)[h,i] CHEM 6820 Seminar (1)[e] Elective*, Advanced Topics[g]	CHEM 6850 Meth Grad Research (3)[f,i] CHEM 6820 Seminar (AU)[e] Elective*, Advanced Topics[g] or Research[h,i]	CHEM 6910 Thesis (3)[f,i] CHEM 6820 Seminar (AU)[e] Elective*, Advanced Topics[g] or Research[h,i]

***Electives (to 45 units. At least 23 units for the M.S. degree must be 6000-level) Electives must be approved by your advisor:** CHEM 4411 (3), CHEM 4412 (3), CHEM 4413 (3), CHEM 4430 (3), CHEM 4440 (4), CHEM 4431 (4), CHEM 4450 (3), CHEM 4460 (3), CHEM 3531 (2), CHEM 3532 (2), CHEM 4161 (3), CHEM 4162 (3), CHEM 4311 (3), CHEM 3531 (4), CHEM 3531 (4), CHEM 6430 (4), BIOL 6140 (4), BIOL 4450 (4), BIOL 6151 (5), BIOL 6152 (5), CHEM 4240 (4), CHEM 6410 (3).

[a]Offered every other Fall.
[b]Requires passing grade on Physical Chem placement exam or completion of Chem 3511-2-3 with a grade of B or better.
[c]Requires passing grade on Organic Chem placement exam or completion of Chem 3301-2-3 with a grade of B or better.
[d]Strongly advised for all MS Chemistry students.
[e]First time students should audit this course. Students should attend seminar all quarters of the MS program, 3 quarters for credit.
[f]Taken in last quarter or the quarter preceding graduation.
[g]May be repeated for credit. A total of 9 units of Advanced Topics classes are required for Plan A.
[h]Up to 9 units of CHEM 6830 and 4 units of CHEM 6900 may be taken.
[i]These must be arranged well in advance with an instructor and may occasionally be available in Summer quarters.
**Remedial classes will not count towards the MS degree.

B.S. Program in Chemistry

	FALL	WINTER	SPRING
First Year	CHEM 1101 General Chemistry I (5)* MATH 1304 Calculus I (4) GE	CHEM 1102 General Chemistry II (5) MATH 1305 Calculus II (4) GE	CHEM 1103 General Chemistry III (5) MATH 2304 Calculus III (4) GE
Second Year	CHEM 2200 Quantitative Analysis (5)** CHEM 3301 Organic Chemistry I (5)* PHYS 1001 General Physics I (5) GE	CHEM 3302 Organic Chemistry II (5) PHYS 1002 General Physics II (5) CS 1020 Introduction to Computers or CS 1160 Introduction to Computer Science and Programming Methods (4) GE	CHEM 3303 Organic Chemistry III (5) PHYS 1003 General Physics III (5) MATH 2101 Elements of Linear Algebra (4) GE

GE – General Elective

ME – Major Elective

Chemistry Electives (3- 4 courses, 11-12 units): CHEM 4311 (4), CHEM 4412 (4), CHEM 4430 (4), CHEM 4521(4), CHEM 4601(4), CHEM 4602 (4), CHEM 4810 (2), CHEM 4413 (4), CHEM 4700 (2), CHEM 4900 (1-4). (No more than four units of CHEM 4810 and CHEM 4900 combined may be applied to the major).

*Sequence may be taken W, Sp, Su
**Offered during summer quarter

B.S. Program in Chemistry

	FALL	WINTER	SPRING
Third Year	CHEM 3511 Physical Chemistry I (3) ME GE	CHEM 3512 Physical Chemistry II (3) CHEM 3531 Physical Chemistry Laboratory I (2) CHEM 4240 Instrumental Methods of Analysis (4) GE	CHEM 3513 Physical Chemistry III (3) CHEM 3532 Physical Chemistry Laboratory II (2) ME GE
Fourth Year	CHEM 4161 Advanced Inorganic Chemistry I (3) CHEM 4411 General Biochemistry I (4) or CHEM 3400 Introductory Biochemistry (4) ME GE	CHEM 4162 Advanced Inorganic Chemistry II (3) ME GE	CHEM 4180 Inorganic Chemistry Laboratory (2) ME GE

GE – General Elective

ME – Major Elective

Chemistry Electives (3- 4 courses, 11-12 units): CHEM 4311 (4), CHEM 4412 (4), CHEM 4430 (4), CHEM 4521(4), CHEM 4601(4), CHEM 4602 (4), CHEM 4810 (2), CHEM 4413 (4), CHEM 4700 (2), CHEM 4900 (1-4). (No more than two units of CHEM 4810 and CHEM 4900 combined may be applied to the major).

Appendix H

New Tenure Track Faculty Request Justification - Biochemist
Department of Chemistry and Biochemistry
November, 2010

Summary Justification for the Position

Overview:

This is a request for a tenure track faculty position in biochemistry or a closely related field. The Department of Chemistry and Biochemistry offers B.S. Biochemistry and B.A. Biochemistry degree programs. We also offer two Biochemistry Options under the M.S. Chemistry degree program. The Biochemistry programs provide excellent preparation for careers in the pharmaceutical and biotechnology industries, for teaching at the high school or community college level, for entry into Ph.D. programs and as preparation for health professional programs in medicine, pharmacy, dentistry, optometry and veterinary medicine. A new faculty position is needed to maintain the quality of the biochemistry courses serving students majoring in this field and related disciplines.

Strategic goals:

Our program aims are well aligned with the university mission of providing an academically rich learning experience that prepares students to realize their goals, pursue meaningful work and contribute to their community. In terms of the undergraduate Biochemistry degrees and the Master's Options in Biochemistry, we strive to offer a broad range of chemistry and biochemistry courses that cover basic principles but also explore specialized areas and include recent advances. We want our graduates to be prepared to succeed in a variety of career choices. We recognize the fast pace of research in biochemistry, and try to prepare our students to embrace new concepts and to appreciate advances in experimental methods and instrumentation. In our courses we encourage students to think critically about the use of chemicals in society and about the responsibilities of scientists to contribute to societal issues relating to chemistry and biochemistry. Because of the increases in enrollment in our biochemistry courses in recent years and the death of one of our biochemists, our ability to fulfill this mission is in jeopardy.

Needs served by the position:

The most pressing needs to be served by the requested position are the acquisition of a qualified instructor to teach upper division and graduate courses in biochemistry, addition of supervisory capacity for research and literature projects for the growing number of Master's students opting to study biochemistry, and help in updating the biochemistry curriculum.

The Department of Chemistry and Biochemistry currently has two faculty members with a specialization in biochemistry. One is Chair and teaches a reduced load. The other was hired in 2006 to teach the extra class sections derived from earlier increases in the number of Biochemistry and Biological Science majors (who take biochemistry courses). That same year a third Biochemistry faculty member passed away suddenly. Because of a failed Search in 2008-09 and subsequent budget issues, he has never been replaced. In the meantime the department FTES has risen 28% and part-time lecturers are now teaching 50% (8/16) of the upper division and graduate biochemistry course sections. As a result, the quality of the instruction for many of the majors level biochemistry courses has been compromised and the turnover rate among the instructors is high. This is a real disservice to the students in the biochemistry degree programs and in related programs that require our courses. Currently about 60% of the undergraduate students matriculating in the department are biochemistry majors.

The number of students in the Chemistry Master's program has increased significantly over the last five years, increasing from 35 students in Fall 2005 to 55 in Fall 2009. More than half of the Master's students emphasize biochemistry in their curricula and many choose one of the Options in Biochemistry under the M.S. Chemistry program. There are currently not enough biochemistry faculty to handle supervision of these Master's students. The new biochemist would be expected to establish a research program in this area and supervise both thesis and non-thesis Master's candidates. Clearly, a new faculty member in the area of biochemistry is needed to maintain and improve the quality of our programs.

Student Demand:

The number of Biochemistry majors has increased moderately over the last five years. The Master of Science in Chemistry program has increased 57% and the department FTES has increased 28%. The number of students taking biochemistry courses has increased about 40%. The popularity of the Cell and Molecular Biology Option under the B.S. Biological Science degree program is responsible for some of this increase. Students in that program are now required to take more biochemistry. At the same time the enrollments in biochemistry courses have increased, the number of biochemistry faculty has decreased from three to two because of the death of one of the biochemists.

Faculty Composition

a. Over the last five years one tenured faculty member retired (2009) and another passed away (2006). Two FERPers completed their service (both in 2007) and one tenured faculty member entered the FERP program (2006). During this same period, three new tenure track faculty were hired. **The net loss was 0.39 position.**

b. **In 2009, the latest year for which the Fall numbers are available, the ratio of tenured/tenure track faculty to total FTEF for the Department of Chemistry and Biochemistry was 0.49.** In comparing the numbers for the last five years, it is apparent that a significant drop in the ratio occurred between 2006 and 2007. In 2005

and 2006 the ratios were 0.69 and 0.70, whereas for 2007, 2008 and 2009 the ratios were 0.44, 0.35 and 0.49, respectively.

c. The Department has an acute need for a biochemist. Dr. Larry Scheve, the biochemist who passed away unexpectedly in 2006, has not been replaced. During the past four years it has been necessary to hire part-time lecturers to teach 50% (8/16) of our upper division and graduate biochemistry courses. As a result the quality of the instruction for many of the majors level biochemistry courses has been compromised and the turnover rate among the instructors is high. This is a real disservice to the students in the biochemistry degree programs and in related programs that require our courses.

d. **The total number of Chemistry and Biochemistry majors in the Fall Quarter headcount for 2009 was 203; for Spring 2010 it was 193.** This includes both undergraduate and graduate students. **For Fall 2010 the number of students working toward a minor in chemistry was 68. The ratio of majors to tenured/tenure track faculty is 193-203 / 7.50 or in the range of 25.7 to 27.1.**

e. The Five Year Hiring Plan established at the time of our last Academic Program Review (2007-08) called for the addition of five new faculty members between 2007 and 2012. At that time two faculty searches were in progress and **it was anticipated that we would immediately hire a Biochemist and a Physical Chemist. We did hire the Physical Chemist, but the Search for a new Biochemist failed. Subsequent budget issues precluded completion of the Search for a Biochemist, leaving the department with a big deficiency in this area.**

The other planned hires include an Analytical or Inorganic Chemist, another Biochemist and an Organic chemist. The Analytical/Inorganic Chemist is needed to teach the General Chemistry series, several analytical courses, and the Advanced Inorganic Chemistry series. Because the accrediting agency for our B.S. Chemistry degree requires that courses certified for the degree be taught by regular faculty, it has been necessary to ask faculty to teach outside of their specialties to cover these courses. As a result, part-time lecturers have taught some of the classes that should be taught by regular faculty. This situation will be alleviated with a new Analytical /Inorganic Chemist hire.

Since enrollments in the Biochemistry area continue to increase and because we have added a non-thesis Biochemistry option to our Master's degree plan, the projected need for a second Biochemist appears to be materializing. However, at this time we are most anxious to obtain approval for the first Biochemistry hire. In our Five Year Plan we also projected the eventual need for another Organic Chemist to replace Richard Luibrand, who had started his FERP service in 2006. Now the need for a new Organic Chemist is looming since Dr. Luibrand will retire permanently in 2011.

To maintain American Chemical Society (ACS) accreditation for the B.S. Chemistry degree, we are required to provide research opportunities for undergraduates. Also, with a growing graduate program, new faculty are needed to supervise Master's

research projects. The shortage of tenure track faculty in our department has put an unusually heavy burden on the current faculty in this area. New faculty are needed to establish research programs and supervise Master's and undergraduate research.

Curriculum

a. Ten of 48 courses (21%) offered by the Chemistry and Biochemistry Department satisfy General Education requirements. The department hopes to add more GE courses in the near future.

b. Online teaching would not be a strict requirement of this position but the new faculty member would be encouraged to develop online courses where appropriate. Every faculty member in the department, including this new hire, is required to teach at other campus sites if our program makes that necessary. The laboratory facilities on the Concord campus have recently been outfitted for the teaching of Pre-Nursing chemistry courses and these courses were taught there in 2008-09 and 2009-10. It is anticipated that a new faculty hire would teach on the Concord campus.

c. The position would represent a central component of the education of Biochemistry majors and graduate students pursuing an Option in Biochemistry under the M.S. Chemistry degree program. As mentioned above, part-time lecturers are currently teaching 50% (8/16) of our upper division and graduate biochemistry courses. As a result, the quality of the instruction for many of the majors level biochemistry courses has been compromised. Since 60% of our undergraduates major in Biochemistry and over half of our Master's students are pursuing a Biochemistry Option, a significant portion of our students would be positively impacted by the hiring of a new tenure track biochemist.

Scholarship

a. The potential for scholarly success should be high as the individual chosen will be expected to have graduate training in biochemistry or a related field and be prepared to establish a research program appropriate for undergraduate and Master's level students. In the past most applicants for tenure track positions in our department have had postdoctoral experience as well. Our last three hires have established active research programs and published in peer-reviewed scientific journals. Students working with them have given numerous research presentations at scientific meetings. It is anticipated that the new hire would attain a similar level of scholarly success.

b. All of our recent hires have applied for external and internal support soon after arriving at CSUEB. All have been awarded internal grants through the Faculty Research Support Program and two have obtained funding through the Sieber-Tombari Interdisciplinary Research Award. Each has been awarded a system wide CSUPERB grant in the range of $10,000-$15,000, one received a COAST grant and another a CSU-Agricultural Initiative Grant ($13, 400). All three have also been

awarded large grants ranging from ~$75,000 to $450,000 through external funding from the National Science Foundation, the Research Corporation and the Bechtel and Broadcom Foundations. It is anticipated that a new hire would achieve similar success with external/internal funding.

c. Replacement is not critical to the scholarly activity of units outside the College of Science. Scholarly collaboration with faculty within the College is likely, depending on the professional interests of the new faculty member. Currently four of the seven Chemistry and Biochemistry faculty members collaborate with faculty in other departments within the College of Science.

d. The faculty in the Chemistry and Biochemistry Department have helped to increase FTES by teaching larger classes and have supported and maintained an active and growing Master's program by supervising an average of seven Master's students each at any given time (up from ~3 four years ago) with no compensation. They have helped our constantly turning over pool of lecturers "learn the ropes," especially with regard to laboratory procedures and safety. At the same time they have willingly taken on the increasing burden of committee work and special projects that keep the university functioning smoothly and enhance its reputation.

e. All seven Chemistry and Biochemistry faculty have been successful in obtaining external funding from government and non-profit funding agencies and from private industry over the last few years. The various awards have been used for individual and collaborative research projects involving students, to purchase large instruments, and for curriculum development and outreach activities.

Recruitment

a. In preparing our recruitment plan we will include the widest possible circulation of the position announcement. We will directly contact Chairpersons in departments at universities and colleges that are known to produce high-quality minority Ph.D. Chemists and Biochemists and we will post the position on the websites of established science organizations with minority membership such as SACNAS (Society for Advancement of Chicanos and Native Americans in Science) and The Black Collegian Online. We will also consult with the CSUEB Diversity and Equity Liaison Officer for additional suggestions.

b. We do not have a pressing need for a senior hire.

c. We would be happy to do a combined advertisement with another department that wishes to advertise in Science and on the websites mentioned about in section a.

New Tenure Track Faculty Request Justification - Analytical Chemist
Department of Chemistry and Biochemistry
November, 2010

Summary Justification for the Position

Overview:

This is a request for a tenure track faculty position in analytical or inorganic chemistry. Areas of specialization might include nanotechnology, materials science, bioinorganic chemistry or environmental chemistry. The Department of Chemistry and Biochemistry offers five undergraduate degree options in Chemistry and Biochemistry and a Master of Science degree in Chemistry. The Chemistry programs provide excellent preparation for careers in the chemical and pharmaceutical industries, environmental chemistry, forensic science, teaching at the high school or community college level and entry into a Ph.D. program. A new faculty position is needed to maintain the quality of the chemistry courses serving students majoring in chemistry and related disciplines.

Strategic goals:

Our program aims are well aligned with the university mission of providing an academically rich learning experience that prepares students to realize their goals, pursue meaningful work and contribute to their community. In terms of the undergraduate and graduate Chemistry degrees, we strive to offer a broad range of courses that cover basic principles but also explore specialized areas and include recent advances. We want our graduates to be prepared to succeed in a variety of career choices. We recognize the fast pace of research in chemistry, and try to prepare our students to embrace new concepts and to appreciate advances in experimental methods and instrumentation. In our courses we encourage students to think critically about the use of chemicals in society and about the responsibilities of scientists to contribute to societal issues relating to chemistry. Because 51% of our courses are currently taught by part-time lecturers, our ability to fulfill this mission is in jeopardy.

Many chemistry courses are taken by students in other degree programs such as Biological Science, Engineering, Earth and Environmental Sciences, Physics, Pre-Nursing and Health Science. Growth in these programs has led to significant increases in enrollments in chemistry courses. The increased interest in chemistry has led to a shortage of tenure track faculty in the department. A new chemistry position is needed to bring the percentage of department courses taught by tenured or tenure track faculty closer to the system-wide target of 75%. The addition of a new tenure track chemist will allow the department to maintain excellence in teaching and provide modern research opportunities for graduate students.

Needs served by the position:

The most pressing needs to be served by the requested position are the acquisition of a qualified instructor to teach majors-level inorganic and analytical chemistry courses, addition of supervisory capacity for research and literature projects for the growing number of Master's students, and help in updating the analytical chemistry curriculum.

Over the last five years the number of Chemistry majors increased gradually (from 50 in 2005 to 56 in 2009). The Minor in Chemistry remains strong, with 68 students declared for Fall 2010. Many chemistry courses are taken by students in other degree programs such as Biological Science, Engineering, Earth and Environmental Sciences, Pre-Nursing and Health Science. Growth in these programs has led to significant increases in enrollments in chemistry courses. The department FTES has increased 28% since 2005 and it is now necessary for 51% of our courses to be taught by part-time lecturers of variable quality and with a high turnover rate. As a result, the quality of the instruction for many of the chemistry courses has been compromised.

Most of the analytical instrumentation courses are now taught by part-time lecturers. For several of the large instruments that students should learn to use, there is no faculty member to take responsibility for troubleshooting or designing modern experiments. There are also instruments that the department should acquire to remain current, but no analytical chemist to apply for funding in those areas or to maintain the instruments if they were acquired. A new tenure track Chemistry position is needed to aid the current faculty in providing the instrumentation skills our students should acquire.

The number of students in the Chemistry Master's program has increased significantly over the last five years, increasing from 35 students in Fall 2005 to 55 in Fall 2009. The current tenured/tenure track faculty are overburdened with the supervisory duties for overseeing the research or literature projects for the increased numbers of Master's students. The new Chemist would be expected to establish a research program in his or her area of expertise and supervise both thesis and non-thesis Master's candidates. Clearly, a new faculty member in the area of Analytical / Inorganic Chemistry is needed to maintain and improve the quality of our programs.

Student Demand:

The number of Chemistry majors has increased moderately over the last five years. The Master of Science in Chemistry program has increased 57% and the department FTES has increased 28%. A number of chemistry courses are required for other degree programs (Biological Sciences, Physics, Engineering, Environmental Science, Nursing, Health Science). Increases in these programs have led to increases in chemistry enrollments.

Faculty Composition

a. Over the last five years one tenured faculty member retired (2009) and another passed away (2006). Two FERPers completed their service (both in 2007) and one tenured faculty member entered the FERP program (2006). During this same period, three

new tenure track faculty were hired. **The net loss was 0.39 position.**

b. **In 2009, the latest year for which the Fall numbers are available, the ratio of tenured/tenure track faculty to total FTEF for the Department of Chemistry and Biochemistry was 0.49.** In comparing the numbers for the last five years, it is apparent that a significant drop in the ratio occurred between 2006 and 2007. In 2005 and 2006 the ratios were 0.69 and 0.70, whereas for 2007, 2008 and 2009 the ratios were 0.44, 0.35 and 0.49, respectively.

c. Increased enrollments without a corresponding increase in tenure/tenure track faculty has led to a situation where 51% of our courses are now taught by part-time lecturers. There is a shortage of faculty to maintain and upgrade the chemistry programs, particularly in the area of analytical chemistry, which is a key area of training for students planning to work in industry. This is a real disservice to the students in the chemistry and biochemistry degree programs, and especially to students who minor in chemistry to acquire instrumentation skills.

d. **The total number of Chemistry and Biochemistry majors in the Fall Quarter headcount for 2009 was 203; for Spring 2010 it was 193.** This includes both undergraduate and graduate students. **For Fall 2010 the number of students working toward a minor in chemistry was 68. The ratio of majors to tenured/tenure track faculty is 193-203 / 7.50 or in the range of 25.7 to 27.1.**

e. The Five Year Hiring Plan established at the time of our last Academic Program Review (2007-08) called for the addition of five new faculty members between 2007 and 2012. At that time two faculty searches were in progress and **it was anticipated that we would immediately hire a Biochemist and a Physical Chemist. We did hire the Physical Chemist, but the Search for a new Biochemist failed. Subsequent budget issues precluded completion of the Search for a Biochemist.**

The other planned hires include an Analytical or Inorganic Chemist or someone with expertise in both areas, another Biochemist and an Organic chemist. The Analytical / Inorganic Chemist is needed to teach the General Chemistry series, several analytical courses, and the Advanced Inorganic Chemistry series. Because the accrediting agency for our B.S. Chemistry degree requires that courses certified for the degree be taught by regular faculty, it has been necessary to ask faculty to teach outside of their specialties to cover these courses. As a result, part-time lecturers have taught some of the classes that should be taught by regular faculty. This situation will be alleviated with a new Analytical /Inorganic Chemist hire.

Since enrollments in the Biochemistry area continue to increase and because we have added a non-thesis Biochemistry option to our Master's degree plan, the projected need for a second Biochemist appears to be materializing. In our Five Year Plan we also projected the eventual need for another Organic Chemist to replace Richard Luibrand, who had started his FERP service in 2006. Now the need for a new Organic Chemist is looming since Dr. Luibrand will retire permanently in 2011.

To maintain American Chemical Society (ACS) accreditation for the B.S. Chemistry degree, we are required to provide research opportunities for undergraduate research. Also, with a growing graduate program, new faculty are needed to supervise Master's research projects. The shortage of tenure track faculty in our department has put an unusually heavy burden on the current faculty in this area. New faculty are needed to establish research programs and supervise Master's and undergraduate research.

Curriculum

a. Ten of 48 courses (21%) offered by the Chemistry and Biochemistry Department satisfy General Education requirements. The department hopes to add more GE courses in the near future.

b. Online teaching would not be a strict requirement of this position but the new faculty member would be encouraged to develop online courses where appropriate. Every faculty member in the department, including this new hire, is required to teach at other campus sites if our program makes that necessary. The laboratory facilities on the Concord campus have recently been outfitted for the teaching of Pre-Nursing chemistry courses and these courses were taught there in 2008-09 and 2009-10. It is anticipated that a new faculty hire would teach on the Concord campus.

c. The position would represent a central component of the educational experience for students majoring or minoring in Chemistry or related fields. As mentioned above, part-time lecturers are currently teaching 51% of the chemistry curriculum. As a result the quality of instruction in the department has been compromised.

Scholarship

a. The potential for scholarly success should be high as the individual chosen will be expected to have graduate training in analytical and/or inorganic chemistry and be prepared to establish a research program appropriate for undergraduate and Master's level students. In the past most applicants for tenure track positions in our department have had postdoctoral experience as well. Our last three hires have established active research programs and published in peer-reviewed scientific journals. Students working with them have given numerous research presentations at scientific meetings. It is anticipated that the new hire would attain a similar level of scholarly success.

b. All of our recent hires have applied for external and internal support soon after arriving at CSUEB. All have been awarded internal grants through the Faculty Research Support Program and two have obtained funding through the Sieber-Tombari Interdisciplinary Research Award. Each has been awarded a system wide CSUPERB grant in the range of $10,000-$15,000, one received a COAST grant and another a CSU-Agricultural Initiative Grant ($13,400). All three have also been awarded large grants ranging from ~$75,000 to $450,000 through external funding from the National Science Foundation, the Research Corporation and the Bechtel and

Broadcom Foundations. It is anticipated that a new hire would achieve similar success with external/internal funding.

c. Replacement is not critical to the scholarly activity of units outside the College of Science. Scholarly collaboration with faculty within the College is likely, depending on the professional interests of the new faculty member. Currently four of the seven Chemistry and Biochemistry faculty members collaborate with faculty in other departments within the College of Science.

d. The faculty in the Chemistry and Biochemistry Department have helped to increase FTES by teaching larger classes and have supported and maintained an active and growing Master's program by supervising an average of seven Master's students each at any given time (up from ~3 four years ago) with no compensation. They have helped our constantly turning over pool of lecturers "learn the ropes," especially with regard to laboratory procedures and safety. At the same time they have willingly taken on the increasing burden of committee work and special projects that keep the university functioning smoothly and enhance its reputation.

e. All seven Chemistry and Biochemistry faculty have been successful in obtaining external funding from government and non-profit funding agencies and from private industry over the last few years. The various awards have been used for individual and collaborative research projects involving students, to purchase large instruments, and for curriculum development and outreach activities.

Recruitment

a. In preparing our recruitment plan we will include the widest possible circulation of the position announcement. We will directly contact Chairpersons in departments at universities and colleges that are known to produce high-quality minority Ph.D. Chemists and Biochemists and we will post the position on the websites of established science organizations with minority membership such as SACNAS (Society for Advancement of Chicanos and Native Americans in Science) and The Black Collegian Online. We will also consult with the CSUEB Diversity and Equity Liaison Officer for additional suggestions.

b. We do not have a pressing need for a senior hire.

c. We would be happy to do a combined advertisement with another department that wishes to advertise in Chemical and Engineering News or Science and on the web sites mentioned about in section a.