

ACADEMIC PROGRAM REVIEW REPORT

DEPARTMENT OF CHEMISTRY
College of Natural Sciences and Mathematics

Spring 2009

SUMMARY OF COMMENDATIONS AND RECOMMENDATIONS

Commendations to the Department of Chemistry

1. Academic programs (undergraduate and graduate) offered in the department are of high quality.
2. Faculty in the department are a hard working, dedicated group of professionals who take pride in their academic programs and in the lab based, applied approach they use in their programs.
3. The department faculty demonstrate a strong commitment to research, to involving both undergraduate and graduate students in their research, and to obtaining external funding.
4. Expectations for retention, tenure and promotion are clearly defined and understood at the department and college level.
5. The sense of community and collegiality in the department is strong.
6. The department's self-governance process is effective.
7. The department has made important changes and improvements in their assessment plan.
8. The department chair has established herself as a strong leader in the department. She is well respected by her colleagues in and out of the department, and by her dean.
9. The department staff is effective at their jobs and communication with the college office staff is excellent.
10. The lab/stockroom staff are highly valued and engaged in the learning process. They pride themselves in supporting the faculty and students and they are an important part of the safety process.
11. The department has done a number of things to address the failure rate in CHEM 4 and CHEM 1A. They have taken a multifaceted approach in addressing the problem.

Recommendations to the Department of Chemistry

1. The department should continue its efforts to address the failure rate for CHEM 4 and CHEM 1A. An analysis of the effectiveness of existing efforts should be done to identify what is working and what isn't. In addition, new tactics should be added when appropriate; working with the Center for Teaching and Learning and looking at peer mentoring for example. Finally, continued direct involvement with the dean on this issue is important.
2. The strong commitment to involving students in the research process must be accompanied by recognizing faculty for their efforts. This should be done in various ways including workload credit.
3. The needs for operating funds, lab supplies, and lab equipment will continue to be an issue for the department. The department, working with the dean, should develop a long-range budget plan which addresses this issue. This is particularly important when it comes to equipment needs.
4. Adequate teaching space, lab space, faculty office space, and stockroom space is an important issue for the department; current levels are not adequate. It is critical that the department continue its involvement in the planning for Science II. In addition,

- the department should look at the possible continued use of lab/teaching/research space in Sequoia Hall even after the move to Science II is made.
5. The department should continue its efforts in improving the training of teaching associates.
 6. The department should work with the dean to develop a long-range hiring plan. There is an immediate need for an Inorganic Chemist; the department should work with the dean to secure this position this year.
 7. While there have been improvements in the department's webpage, the website should be modernized and updated with current information.
 8. Safety is an important goal of the department. While the safety recorded for the department has been outstanding, there is still room for improvement. The department's Safety Committee should become more active. Safety policies and procedures should be collected and distributed in an organized fashion. Training of faculty, staff, and students should be continued and formalized as part of a comprehensive department safety plan. Safety issues and working space in the stockroom and in faculty offices should be examined and addressed.
 9. The department chair should meet with the university faculty assessment coordinator to discuss a long-range assessment plan. Utilizing the data from the annual Fact Book, surveys and/or focus groups with current students, alumni, etc. could be considered as well.

Recommendations to the Dean of NSM

1. Continue to work with the department in addressing the failure rate in CHEM 4 and CHEM 1A.
2. Work with the department to give work-load recognition for faculty supervision of student research projects.
3. Work with the department to develop a long-range budget plan to address their needs for operating funds, lab supplies, and lab equipment.
4. Work with the department to address space needs though continued department involvement in the planning of Science II and an examination of continued use of Sequoia Hall.
5. Assist the department with the training of teaching associates by giving summer support to faculty for training purposes.
6. Work with the department to develop and long-range hiring plan. There is an immediate need for an Inorganic Chemist.
7. Support the department in the formalization of a comprehensive safety plan.
8. Continue to find ways to effectively communicate with the department chair and department faculty.

Recommendations to the Provost

1. Continue to work with the department and college in addressing the failure rate in CHEM 4 and CHEM 1A.
2. Work with the department and the college to address space needs.

Recommendations to the Faculty Senate

The Chemistry Program Review Team recommends that the Chemistry Program be approved for six years or until the next program review.

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DEPARTMENT OF CHEMISTRY

College of Natural Sciences and Mathematics

Review Team Members:

Fred D. Baldini, Kinesiology and Health Science Department (Chair)
Miles Roberts, Geography Department
Kimberly Gordan-Biddle, Child Development Department
Anne-Louise Radimsky, Computer Science Department

Documents Consulted:

The Department of Chemistry Self-Study, Fall 2008
The Department of Chemistry's Response to Recommendations from the 2001 Program Review
The Department of Chemistry Fact Book, 2007
Report from the External Consultant Dr. Bradley M. Stone, Chemistry Chair, San Jose State U.

Informational Source

A tour of the Chemistry Facilities

Persons Interviewed:

Department Chair

Dr. Susan Crawford

Faculty (tenured)

Dr. Roy Dixon
Dr. James Hill
Dr. Mary McCarthy-Hintz
Dr. Kathie McReynolds
Dr. James Ritchey
Dr. Linda Roberts
Dr. Cynthia Kellen-Yuen

Faculty (probationary)

Dr. Brad Baker
Dr. Ben Gherman
Dr. James Miranda
Dr. John Spence
Dr. Tom Savage

Office Staff

Ms. Evelyn Bradley-Owens
Ms. Michelle Heflin

Stockroom and Electronic Staff

Ms. Barbara Coulombe
Ms. Janee Hardman
Mr. John Disney
Mr. Ted Ferrera

Students

CHEM 231 class

External Consultant

Dr. Bradley Stone, Chair, Department of Chemistry, San Jose State University

Dean

Dr. Jill Trainer, Dean, College of Natural Sciences and Mathematics

Others

Dr. Rose Leigh Vines, Chair, Department of Biology
Dr. Terry Underwood, Campus Assessment Coordinator

Introduction

The Department of Chemistry was one of seven departments that used the new pilot program for program review for the 2007-2008 cycle. In the new process, the departments under review have a choice of three options for their program review. Because the Department of Chemistry has a relatively new faculty, which is much different than what was present during their last program review; they chose a combination of Option 1 and 3. Option 1 is the traditional form of program review which includes an examination of the department's programs, students, faculty and staff. Option 3 is a focused inquiry on a particular issue or issues.

Section I: General Information (Option 1)

In the first two sections of this report, the Program Review Committee will comment on the portions of Department of Chemistry's self-study which address Option 1.

Programs and Degree Options

The chemistry department currently offers a BS degree in Chemistry (Certified by the American Chemical Society - ACS) and BA degree in chemistry with three different concentrations including General, Biochemistry, and Forensic Chemistry. The department also offers two Master of Science degrees in chemistry, including a new MS degree with a concentration in Biochemistry. The department recently received approval for a new BS in Biochemistry (fall 2010) and has future plans for a MS degree in Science Education. Finally, there have been new courses created and modification to existing courses, including changes to the chemistry curriculum offered to nursing students and liberal studies students.

The current number and types of programs offered by the department are appropriate and the department is maintaining quality during tight budget times. However, the department struggles to maintain the teaching contact hours below the ACS acceptable level. As new programs are approved or proposed in the future, the availability of resources and the ability to offer such programs should be evaluated.

Faculty

The composition of the faculty in the Department of Chemistry has changed dramatically since the last program review. The current membership of the department includes 17 full-time faculty; three full professors (one FERP), six associate professors, seven assistant professors, and one full-time lecturer. In addition, there are a number of part-time faculty and graduate teaching assistants. There appears to be good diversity of expertise in the department, addressing an issue raised in the previous program review. The most pressing current need for a new hire is in the area of inorganic chemistry. This is of particular urgency due to a FERP ending this year. Future hiring needs should be addressed by developing a long-range hiring plan with the dean.

In the area of teaching, it is clear that the faculty are committed to being effective in the classroom, and they are committed to offering a "hands-on" approach to chemistry. This is accomplished in a couple of ways including the "lab based" curriculum offered in the

department. It is clear to the program review team that the faculty pride themselves in the applied nature of their curriculum and the practical skills their students gain in the program. With declining budget support, the faculty are very concerned about their ability to continue to offer the curriculum in this way.

The amount of scholarly activity by the faculty in the Department of Chemistry is impressive. There is a strong commitment in the department to do research, to involve undergraduate and graduate students in the process, and to publish the work. In addition, the faculty have been very active in grant writing to support their research. These efforts are important to the faculty and are reflected in the RTP process. The involvement of students in the research process is another example of the applied approach taken by the department. While the output in their area of scholarship is impressive, once again the budget situation and the lack of support for faculty to conduct research threaten the department's ability to maintain this impressive scholarly agenda.

In the self-study, the department points out concerns about the contact hours for lab and the WTU credit for these labs. Based on our review, the department is giving the correct workload credit for the labs courses. While the contact time in lab section of a course compared to the contact time for the lecture section, the correct WTU formal are being used.

Other findings for the program review suggest that there is a strong collegial working environment in the department. The self governance structure in the department appears to be functioning well; faculty are participating in the decision making process at the department level. There is a strong and positive working relationship between the faculty and the chair, the clerical staff, and the stock room staff. The chair, faculty, and staff are commended for their dedication to their students and their programs. A special mention should be made concerning Dr. Susan Crawford, the chair of the department. She is well respected by everyone she works with and she has made a strong commitment to serving the department and representing the department to the college, the university, and the outside community.

The department should continue to work with the dean to maintain the applied approach to teaching and the inclusion of students in the research process. This can be done by giving recognition (workload credit) to faculty working with students on research projects, by assisting grant writing efforts with matching campus funds/resources, and by good planning for lab space in the Science II project. The department should continue to work on improving and bring consistency to the training of graduate teaching associates.

Students

During the past five years, there has been significant growth in both the number of chemistry majors and the number of students from other majors taking chemistry courses. The number of chemistry majors has increased 49% (235 to 352) with most of the growth in the undergraduate programs. While there has been growth in FTES in all categories (664 to 823), the most significant growth has occurred in lower division courses; courses taken by both majors and non-majors. There appears to be strong demand for both chemistry courses and for the major itself.

This strong demand has presented challenges for the department. With limited lab space and no major increase in operation expenses, the strain on resources is becoming a problem. Normal wear and tear on equipment, use of chemicals and other supplies, and the workload for the stockroom staff have increased. At the same time, limited lab space, lockers, and equipment have forced the department to look at increasing lab size where possible and offering more lab sections. These options, however, are limited without more space, more faculty, and more equipment/supplies. There will be a limit in how much the department can handle and the implication on faculty workload must be considered. Of equal concern is the increase workload for the stockroom staff, the limited work space available to them, and the increase in course support needed to run the additional lab sections. Safety can be compromised if the situation continues.

The department must look for long-term solutions to these problems. One potential bright spot is the plans for building Science II. It is critical that the department work with the dean and others involved in the planning and design of this building to make sure lab space, stockroom space, and equipment needs are addressed. In addition, while there may be plans for the “old” chemistry lab space in Sequoia Hall, we recommend that one possible use of that space is to keep it with chemistry to help meet the demands for lab classes. Faculty are encouraged to continue their commitment to obtaining outside funds, funds that can have a big impact on equipment and supplies. The department should work with the dean to develop a long-term equipment list to address current and future needs. Finally, the department should continue to look at ways to streamline the curriculum while maintaining the lab based hands on approach to delivering it.

Another challenge the department faces is the ability to continue the involvement of students in research. The department has begun tracking students who present their research findings at professional meeting and the initial data is very encouraging. As stated in their self-study, “The Chemistry Department maintains a long history of embracing the philosophy that we perform our best teaching when we get students into faculty research labs where they can learn while contributing to meaningful real research. The Chemistry Department feels that all students should have the opportunity to partake in these experiences since they can have such a profound impact on their educational preparation.” This is a core value expressed by the members of the department during our interviews with them. The issue that must be addressed is not just the space, equipment, and supplies discussed above, but the workload for faculty. The involvement of students in the research process takes time and energy and the faculty should be compensated for their work. Currently there are three courses associated with the research experience for students; CHEM 189, 198, and 299 and enrollment in these courses has increased by 263% over the past five years. Only CHEM 198 gives faculty workload compensation.

If the Department of Chemistry is going to maintain the research experience for students, faculty should be compensated for their work. This issue was addressed in the external consultants report and listed as the number one recommendation. In addition, space, equipment, supplies, and support for the stockroom staff should be examined and increased if possible.

Staff

Our program review finds that the staff in the Department of Chemistry is a hard working, dedicated group who are committed to the faculty and students. There are two administrative staff members in the department office; one with considerable experience and one relatively new. The office appears to be running effectively and the needs of students and faculty are being met. There is a good line of communication between the department staff and the college staff and they feel supported in doing their jobs.

In addition to the administrative staff, the Chemistry Stockroom currently has four staff members and one instrument technical staff person supporting the department. It was very clear in our interviews with the staff that they care very deeply about what they do, and they are very focused on providing support for faculty and students. They play a key role in the teaching and research activities in the department through support for courses and research projects, and they also play an important role in safety for the department both in and out of the classroom.

The demand on the stockroom has increased significantly as the enrollment in courses and lab sizes have increased. The work space in the stockroom, where they prep for classes, is becoming limited. There also appears to be limits in storage space in and out of the stockroom. As Science II is being planned, the stockroom needs must be addressed.

One final note on safety. As a result of our discussion with faculty, administrators, and staff, it has become clear that safety is an important issue for the department. While the faculty and staff appear to be experts in safety, student safety in the lab, etc, we as outsiders want to ensure that everyone is on the same page. This is not to indicate that there are unsafe conditions in the department. In fact, there have been no major emergencies/accidents in the department for a number of years and the committee commends the department for this impressive safety record. The committee feels that it would be useful to formalize safety procedures so that new students, new faculty, and visitors would have access to safety procedures. There is a department safety committee which hasn't been very active. Our recommendation is to activate the committee, develop or publish existing safety procedures and have a plan for the department. We recommend that the department formalize their procedures and continue to work safety.

Section II - Response to the last Program Review (Option 1)

The Department of Chemistry underwent a program review in 2001 at which time the program review team made 14 recommendations. In general, the department addressed each recommendation at some level and was responsive to the recommendations. Some of the issues addressed by the last program review team are still applicable today. These issues include the recommendation to maintain the American Chemical Society Certification, reduce faculty teaching loads, establish a long-term hiring plan, improve the training of teaching assistants, develop a plan for the replacement of equipment, and look for ways to increase and improve space for faculty and students. The current program review will make recommendation on these issues, not because the Department of Chemistry was unresponsive to the last program review, but because the department continues to be faced with challenges in these areas. As described above, the work load for faculty in the classroom and in the lab with student research projects

continues to be a challenge for purposes of accreditation and for recognizing faculty for the work they are doing. Maintaining adequate space, equipment, supplies, etc. are a continuing challenge. Finally, with regards to training teaching assistants, the department has made great strides through testing, training, and supervising teaching assistants along with the peer mentoring program in the works. We encourage the department to continue with these efforts, especially at a time when the demand for teaching assistants is high.

Section III - Recruitment/Retention (Option 3)

In this section of this report, the Program Review Team will comment on the portions of Department of Chemistry's self-study which address option 3.

Recruitment

Over the past few years, the Department of Chemistry has increased student recruitment efforts with the goal of bringing highly qualified students to the major. The department formed a Recruitment and Retention Committee to help develop their efforts in this area. A number of activities have resulted from the work of this committee and the department including the development of a department brochure and a Power Point presentation which are used in various ways including open houses, preview days, and major fairs. A "welcome and invitation to visit" letter was developed and is sent to students accepted into the program but who have not officially committed. Improvement to the web site, the appointment of a graduate coordinator, and outreach activities to the community colleges have also had positive results. All these activities help explain the increased demand for the major described above. The department is commended for their efforts.

Retention

Another goal for the Department of Chemistry is to improve student retention rates. From 2002 to 2006, the retention of first year students has improved 14%, for second year student 6%, and for third year students 14%. The biggest loss of majors occurs between the freshman and sophomore years; 36% of entering freshman chemistry majors does not return after their first year. This loss appears to be directly related to the failure rate for students taking CHEM 1A (General Chemistry) and CHEM 4 (Chemical Calculations). Both of these courses, particularly CHEM 1A, are characterized by high D, W, and F rates that have been as high as 50% during some semesters. In addition, poor performance in CHEM 1A often leads to poor performance in CHEM 1B. The high failure rate for both majors and non-majors is not unique to CSUS but a finding at many universities. Potential reasons for the high failure rate are include poor high school preparation, improper placement of students in classes, and poor time management and study skills. In addition, data collected by the department over the past five years shows a 70% increase of incoming freshman needing CHEM 4 prior to enrolling in CHEM 1A and a decrease in SAT and GPA scores for the incoming freshman.

To address this failure rate issue, the Department of Chemistry has implemented a number of improvement strategies. These strategies include:

- The implementation of a required diagnostic test to determine student readiness for CHEM 1A and to ensure the proper placement of students in the appropriate classes.
- The implementation of major analysis and revision of CHEM 4 in order to improve student success in CHEM 1A the following semester.
- The department is taking part in the CSU Chancellor's Office initiative "Transforming Course Design." The goal of the initiative is to improve student success rates in high enrollment courses characterized by high failure and repeat rates. There are a number of activities involved with this initiative including regular conference calls with sister institutions, the use of clickers in the classroom, etc. Data from various efforts is currently being analyzed to look for improvements.
- The implementation of "learning communities" associated with CHEM 4 and CHEM 1A.
- The implementation of a new process where the department chairs receives a list of their majors students who are performing poorly after the first exam in CHEM 4 and CHEM 1A. Students are asked to meet with the instructor for counseling and they are asked to meet with their major advisor.
- A practice of trying to schedule CHEM 4 and CHEM 1A during the same time slots to facilitate student transfer from the two classes if needed.
- A change in the course design for CHEM 1A moving from two labs per week to one lab session and one discussion section to help students.
- Including students in undergraduate research activities to get students involved with chemistry, exposure to peers, and exposure to faculty.

It is clear from our review that the Department of Chemistry is making major efforts in addressing the failure rate of their students. We commend them for their efforts and for the multiple ways they are addressing the problem. Another encouraging finding is how closely the department is working with the dean of the college on this issue. Again, it is clear from our review that the issue is being examined from the department on up through the Dean's office and the Provosts office. We recommend that the Department of Chemistry continue their effort, look for new strategies, and analyzed the success of current activities to determine what is having an impact on student success.

Advising

The department has made efforts to improve advising for majors since the last program review. Activities include freshmen orientation during the summer at which a majors advising session is given by the department chair. During this session, the chair describes the programs, discusses the CHEM 4/CHEM 1A options, and gives the students other information including a student handbook. The students also fill out a student profile form which is given to their eventual faculty advisor. Soon after the orientation, students receive a letter with their faculty advisors contact information. The department is considering a policy of mandatory advising for all majors prior to being allowed to register for classes. Graduate advising is handled by the graduate program coordinator which includes new student orientation, distribution of a graduate student handbook and thesis advising.

Section IV – Assessment (Option 3)

The Department of Chemistry has a newly revised assessment plan contained in their self-study. Assessment is done in a number of ways including testing for general chemistry placement, evaluating technical writing skills through evaluation of lab reports, and learning outcome assessment through a capstone poster project. In addition, data from an American Chemistry Society standardized exam and senior exit survey are collected and analyzed. These activities are appropriate and useful for the department in assessing the quality of programs.

In discussing the department's assessment plan with the university assessment coordinator, some possible assessment activities for the future include the development of a multi-year plan that is efficient and useful, develop sampling techniques keyed to program outcomes, and develop rubrics so that scores have criteria. In addition, tying program assessment to budget needs (equipment, lab space, etc.) of the department could be useful in justifying the needs. This could be done as part of developing a long-range budget plan as recommended above. These possible assessment activities, along with others, were shared with the department chair.

Section V – Facilities/Resources/Budget

As pointed out throughout this program review, the Department of Chemistry is facing many challenges due to the current budget situation. Limited operating expense money, increases in enrollment, limited faculty lines, and increased cost of lab supplies and equipment have put strain on the department in delivering its curriculum. The department has taken measure to help including increasing class size where possible, increasing lab fees, and grant writing. While these measures have been helpful, they have not been enough. Finally, adequate classroom, lab space and research space continue to be a concern. Current faculty office space is not adequate and there are some safety concerns with the placement of these offices.

Long-term planning for space, budget, etc. is critical. The department must continue to work with the dean to address their needs. Examination of the curriculum and how it's delivered is needed, continued grant writing is important, and continued work on the plans for Science II is important to help address the needs of the department.