Columbus State University
College of Science
Department of Chemistry and Geology

COMPREHENSIVE PROGRAM REVIEW SELF-STUDY FOR THE BACHELOR OF SCIENCE BACHELOR OF ARTS BACHELOR OF ARTS AND SECONDARY EDUCATION DEGREE PROGRAMS IN CHEMISTRY

January 2007

EXECUTIVE SUMMARY FOR THE
BS, BA, AND BA ED DEGREE PROGRAMS IN CHEMISTRY

Major Findings of the Program's Quality and Productivity

The overall strength or weakness of the chemistry program's quality and productivity is satisfactory. To facilitate the analysis and evaluation of the chemistry program at CSU, our strengths and weaknesses are listed below.

Quality

Strengths

a. All full-time faculty members have terminal (Ph.D.) degrees.
b. Faculty members have a broad range of training across the chemistry discipline.
c. The use of part-time faculty is minimal.
d. Advising is taken seriously and all faculty members serve as academic advisors.
e. Faculty and students interact outside the classroom, through departmental social gatherings, senior research projects, conferences, and mentoring.
f. Students get significant one-on-one attention via mentoring.
g. Our program is comprehensive and exposes students to all areas of chemistry.
h. Our program provides opportunities for students to match their degree program to their individual career goals.
i. All students are required to complete a research project.
j. The quality of our program is assessed annually through a strategic plan and outcomes assessment, and we use this information to improve our program as necessary.
k. There is a modest supply of chemical instrumentation available for teaching upper level courses and research.

Weaknesses

l. There is a limited amount of space available for research.
m. The lab space available for service courses is full to capacity, thus putting a cap on more enrollments.
n. Library holdings (i.e. books, Journals and electronic databases) in chemistry are inadequate.
o. There are no female faculty members in the program.
p. The chemistry program does not have an autonomous budget.
q. The budget is inadequate for the number of student assistants required.
r. The program does not have an NMR spectrometer, which is a vital instrument in chemical analysis.
s. We have a limited number of chemical instruments for general and organic chemistry labs. This limits our equipment-based training in these core chemistry classes.
t. We do not have a chemistry club or student affiliates section of the ACS.
u. Our program is not accredited by the American Chemical Society (ACS). We currently do not meet the requirements for approval by the ACS.

Productivity

Strengths

a. Faculty members are professionally active.
b. The performance of our students on the Major Field Assessment Test remained constant over the past five years and is comparable to the national average.
c. Nearly all of our recent graduates are either successfully employed or pursuing advanced degrees.
d. Minority students are well represented in our program.
e. Compared to other programs/departments at CSU, the chemistry program is very cost-effective.
f. We have a modest budget for maintenance of equipment.

Weaknesses

g. Our program has a low retention rate.
h. Faculty professional development opportunities are constrained by limited funding.
i. The program does not have someone to manage the inventory (i.e. chemicals and glassware).
j. The steady increase in enrollment at the university requires additional sections of lower level chemistry courses. This, in effect, prevents faculty from engaging in research, developing upper level elective courses, attending conferences, and writing quality grant proposals/manuscripts.

List of Recommendations for Improving Program Quality

The recommendations made for improving the quality of the chemistry program is divided into four categories, i.e. teaching, curriculum, students, and faculty. Each of these categories is presented below.

1. Teaching
    a. develop an internship program with industries, state and national labs, and academic institutions
    b. increase the library resources (electronic data bases, journals, and reference books)
    c. get funding for more chemical equipment
    d. administer entrance and exit exams in the introductory courses, i.e. CHEM 1211/1212

2. Curriculum
    a. offer a separate one-semester physical chemistry course for the BA programs
    b. develop additional electives
    c. continue to assess the curriculum annually using the MFAT
    d. apply for ACS approval of the program

3. Students
    a. Implement peer-led tutoring program
    b. Have biannual meetings with all majors in the program
    c. start a chemistry club or student affiliates section of the ACS
    d. provide opportunities for students to attend and present research findings at local, regional, and national ACS meetings
    e. apply for federal funding to support research to engage undergraduate students

4. Faculty
    a. engage the faculty members in a more active role in college-wide activities and community outreach programs
    b. hire an additional faculty member and a stockroom manager
    c. hire a qualified female faculty member to increase gender diversity

List of Recommendations for Improving Program Productivity

The recommendations made for improving the productivity of the chemistry program are presented below.

1. Teaching
    a. aggressively engaged all faculty in recruiting at high schools
    b. provide financial support to the program to hire sufficient numbers of student assistants
    c. aggressively seek funding to support our education outreach

2. Curriculum
    a. review the curriculum annually
    b. publish availability of new electives

3. Students
    a. encourage students to attend conferences and provide the means of attending conferences
    b. encourage and enable students to present research findings at various conferences

4. Faculty
    a. encourage faculty to attend more conferences
    b. engage faculty in mentoring apart from research

Conclusion about the Program's Viability at CSU

CSU is primarily a teaching institution; therefore the chemistry faculty members pay serious attention to the teaching of undergraduates. As directed by ACS, the National Science Education Standards (NSES), and NSF's Directorate for Education and Human Resources, the faculty members are guided by indicators of good teaching/learning: openness to students, respect for students, using student-centered and inquiry-based pedagogies, using computer technology to improve the learning environment, and involving students in research projects so that they get some sense of the "thrill "of the discovery. We are glad to report that our customers (the students) are extremely impressed with the experiences that they receive in the chemistry program. Formative evaluations have provided qualitative comments that attest to the superb job done by the chemistry faculty.

The department of chemistry is experiencing growth and success in teaching and research arenas. The ethnically diverse chemistry faculty members are excellent role models and participate in outreach activities including science demonstrations, recruiting, retaining, and advancing all students (majorities and minorities). For the past 3 years, students have over-subscribed across all chemistry and non-chemistry courses (e.g., Survey of Chemistry I and II, which is mainly for the Nursing Program and non-science majors).

The high demand for advanced chemistry courses is not only attributed to successes in local business sectors but also to the recent increase in the number of students interested in pursuing graduate school or health science degrees (e.g., pharmacy and medical). Moreover, as part of their professional development commitments, faculty members provide support services to a large number of students who are non-chemistry majors (e.g., Biology and Nursing programs). Student internships and faculty professional development programs are enhanced through collaborations with Research I Universities, research labs, and local industries. Hence, the chemistry programs offered by the department are quite viable.

I. Brief Program Overview

The Department of Chemistry and Geology offers three undergraduate degree programs in chemistry, (i.e., Bachelor of Arts (BA), Bachelor of Arts and Secondary Education (BA Ed), and Bachelor of Science (BS)). The BA degree is designed for students interested in going to professional schools, such as medical, dental or pharmacy, or for students seeking employment in the field of education, business, quality control, and environmental fields. The BA Ed in chemistry is designed for students interested in teaching chemistry at the secondary education level. Lastly, the BS degree is designed for students that are interested in graduate school or work in a research laboratory.

The baccalaureate degree programs in chemistry are designed to offer students a solid background in inorganic, analytical, organic, biochemistry, and physical chemistry, as well as exposure to applied chemistry, spectroscopy, and chemical analysis. Graduates are expected to appreciate quantitative interpretation, think independently, and apply skills and knowledge of chemistry to real-world problems. The programs are specifically designed to provide significant outcomes in terms of the relevance of the program to student's need, the ability of students thinking across disciplines, the impact of technology on the program of study, and the understanding of the relation of the program to diversity, multiculturalism and international perspectives. Hence, the degree programs offer an undergraduate chemistry education that provides a quality and comprehensive learning experience. Graduates from the chemistry programs will be able to:

a. demonstrate knowledge of the diverse areas of chemistry, both theoretical and practical
b. communicate the rapidly changing field of chemical knowledge effectively
c. estimate and interpret chemical information in the context of the day-to-day events
d. demonstrate skills in quantitative and qualitative problem-solving related to the chemical sciences
e. demonstrate theoretical knowledge of chemical instrumentation, including the operation of microprocessor controlled instruments
f. integrate the usage of computers in chemistry
g. think independently and apply chemical knowledge to a problem
h. enter into employment in the chemical industry or into graduate or professional schools

II. Summary Findings of the Program's Overall Quality

Repeat the major findings of the program's quality as reported in the executive summary and cite any additional detailed analyses, interpretations, or rationale that support this summary judgment. This summary should be consistent with the pattern of strengths and weaknesses observed among the indicators of program quality that follow.

Perhaps one of the greatest strengths of CSU is its ethnically diverse chemistry faculty. There are seven full-time Ph.D. faculty with expertise in Analytical, Biochemistry, Inorganic, Organic, Physical, and Chemical Education. One part-time faculty coordinates tutorial services in introductory courses. Our university expects new and tenured faculty to be professionally active by teaching, conducting research, and engaging in community outreach activities. Professional development funds enable the faculty to attend scientific meetings and gain new experiences, insights, and methods in teaching and research. Research has shown that computer technology can improve teaching/learning process. Therefore, CSU periodically trains faculty in new computer technologies.

Despite the modest teaching loads (13 to 18 contact hours per week) and mentoring/tutoring, the faculty members still manage to find the time to conduct research and engage in outreach services to the community. The Board of Regents (BOR) recently approved a policy encouraging faculty members to participate in outreach activities at middle/high schools. The new policy has been incorporated into the annual review criteria for assessing and rewarding good teaching and advising. We are glad to report that faculty members (and students) have been receiving exceptional achievements and honors.

The chemistry program prepares students for careers in academia, industry, and government agencies. Students are taught important skills, such as how to think across disciplines, how to use modern technology, and how to work in multicultural settings. Students gain fundamental knowledge and experimental skills through a core set of lower and upper division courses offered through the program. Graduating seniors are required to take the Major Field Assessment Test (MFAT). The MFAT is an exit examination used as an instrument to evaluate the quality of the program and the content delivered in the courses. The MFAT is also used as a device to measure and track students' satisfaction about the services offered through the program. Graduates often express their satisfaction with our program.

The department has sufficient offices, computers, secretarial services, basic laboratory and office supplies, and administrative services. However, there is limited space for research, and the budget is inadequate for student assistants. All instruments are housed in Lenoir Hall at the College of Science building, and all classrooms where chemistry classes are held are equipped with state-of-the-art technology for teaching. Also, library resources are available either at the CSU's libraries or can be obtained through the interlibrary loan system.

The faculty members meet at the end of each semester (or as often as necessary) to review strengths and weaknesses of the program. Our short-term strategy is to improve the program through: recruiting from diverse populations, seeking federal funds for teaching and research, seeking ACS accreditation, hiring an additional faculty members and a stockroom manager, strengthening partnerships with public and private organizations, and expanding our mentoring programs.

II A. The Quality of Teaching Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
<u>Above Average</u>

- *Explain how good teaching is assessed and rewarded.*

Teaching is the primary responsibility for faculty members. Excellence in teaching is assessed and rewarded in order to improve the quality of teaching. Good teaching is assessed using two methods:

> 1) *CSU's Students' Evaluation of Faculty* (CSEF) - At the end of each semester, students anonymously express their views of the way the faculty has taught the course by completing a CSEF questionnaire. On a 1 (strongly disagree) to 5 (strongly agree) scale, the following criteria are assessed by the students: (A) the course, and (B) the instructor's (i) attitudes towards students, (ii) subject matter presentation, (iii) management of classroom atmosphere, (iv) grading practices, and (v) teaching effectiveness
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> 2) Peer-review Evaluation - a colleague in the department attends and evaluates one lecture session per semester.

Good teaching is rewarded through: 1) teaching awards; 2) promotion/tenure/post tenure; and 3) merit pay raise.

- *Explain how good advising is assessed and rewarded.*

CSU's *Center for Academic Advising* (CAA) serves as a central resource for students to gather information about advising. Advisors at CAA work closely with academic departments, offering specialized advising to transfer students, first-year students who have not selected a major course of study, and returning students who are considering changes in their majors. The center encourages students to make informed decisions about their courses. Through *CSU's Early Alert Program*, CSU faculty may refer to the CAA those students who need academic or personal counseling. With information provided by faculty, students are contacted and encouraged to take advantage of tutorial services, study skills workshops, and other programs that may benefit them academically and personally. Each semester, the center sponsors workshops on upper-level course requirements for a variety of majors.

In summary, there is no separate mechanism for assessing and rewarding good advising. To our knowledge, CSU students do not complete BOR's Academic Advising Questionnaire. Advising is regarded as part of university service. Therefore each faculty member is required to advise at-least ten students per semester. The only instrument available for assessing and rewarding good advising is BOR's merit-based pay raise that is assigned based upon recommendations by the chair of the department after the annual review.

- *Describe opportunities for interaction that occur between faculty and students outside the classroom.*

Students and faculty interact outside the classroom in a number of ways. At the beginning of each academic year, students are invited to a departmental meeting. During this meeting each faculty member is introduced and allowed to briefly describe his research/training. Additionally, students are encouraged to attend departmental seminars given by guest speakers who come to present their research and/or recruit for their graduate programs. Moreover, junior and senior level students accompany faculty members to regional and national ACS meetings. Hence, faculty members spend a reasonable amount of time mentoring students outside of the classroom.

- *Indicate the availability of tutoring.*

All chemistry faculty members use office hours to offer tutorial assistance to students. One faculty member offers tutorial assistance twice a week for students in the Principles of Chemistry courses (CHEM 1211/1212). Additional tutorials in introductory level courses are conducted by a retired chemistry professor. Furthermore, a peer-led tutorial program has been incorporated into several courses (e.g., Survey of Chemistry and Organic Chemistry).

- *Describe opportunities for internships, service-learning, practica, study abroad, and career planning and placement.*

Most of the faculty members have on-going research projects involving one or two undergraduates during the academic year (Spring and Fall). Participation in research breeds excitement for science that spills over into students' coursework and onto other students. Therefore, student-faculty research projects are excellent vehicles for recruiting students into the chemistry program. In addition to faculty-directed projects, several research-based courses are offered (CHEM 4795, CHEM 4796 and CHEM 4899). CHEM 4795 and CHEM 4796 are Senior Seminar courses that must be taken by all students in the program. However, Independent Study (CHEM 4899) is offered as an elective and students can take it for academic credits. One of our initiatives in the chemistry program is engaging students in summer internship. Over the past five years we have been successful in securing positions for our students at Ph.D. granting institutions and National Laboratories.

- *Describe methods to be pursued for program improvement.*

The chemistry program has gone through major changes within the last five years. Specifically, five new members were added to replace former members. Our faculty members recognize the value of advising/mentoring, teaching, and research. Hence, we plan to use the following to improve the quality of the program.

a. have biannual meetings with the students
b. conduct student evaluations after advisement week (i.e. Assess advising using BOR's Academic Advising Questionnaire)
c. implement the peer-led tutoring program throughout the chemistry programs
d. seek funding to support research and students during the summer

e. use all faculty contacts/collaborations to locate summer internship positions
f. develop an internship program with industries, national labs, and academic institutions
g. provide opportunities for students to attend and present research findings at local, regional, and national ACS meetings
h. encourage students to present their research findings at various conferences
i. collaborate with major university chemistry programs to gain access to equipment that we do not have
j. start a chemistry club

II B. The Quality of the Curriculum Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Above Average

- *Describe the relationship between the program's curriculum and its outcomes.*

The department offers an undergraduate chemistry education that provides a quality and comprehensive learning experience to students that can serve the needs of the community by taking positions in the public and private sectors related to chemistry. The program prepares students for positions in industry, government agencies, and research laboratories, teaching profession and for admission to graduate programs and professional schools. Also, other science students are taught how chemistry is related to their discipline, and non-science majors are taught how chemistry relates to life and society. The department has designed its program by developing an undergraduate chemistry curriculum that will have significant outcomes in terms of the relevance of the program to students' need, the ability of students to think across disciplines, the impact of technology on the program of study, and the understanding of the relation of the program to diversity, multiculturalism and international perspectives.

The baccalaureate degree program in chemistry consists of BA, BA Ed, and BS degrees. Each degree program has a core set of lower division and upper division courses that provide fundamental knowledge and experimental skills. The BA program provides the opportunity to develop a broad background in chemistry and is appropriate for students who wish to understand the basics, but do not plan a career as a research chemist. The BS degree consists of advanced chemistry, physics and mathematics courses that provide a firm foundation for graduate or professional school. Although there are small differences between the BA and BS programs, the curricula for both degree programs are designed to offer students a solid background in analytical, biochemistry, inorganic, organic and physical chemistry. The curricula for the BA and BS degrees emphasize both theoretical aspects and laboratory experience that will prepare students for future careers. Students are also exposed to environmental chemistry, chemical analysis using different types of instruments, and use of some chemical software. Students obtaining a baccalaureate degree in chemistry should:

a. have the basic knowledge of the theoretical and practical aspects of the diverse areas of chemistry
b. be able to understand and interpret chemical problems related to the real world
c. be able to use the knowledge of course work in designing chemical projects
d. develop written and oral communication skills to relay what they have learned in lectures and laboratories
e. demonstrate skills in quantitative and qualitative problem solving related to chemical science
f. demonstrate theoretical knowledge and ability of operating chemical instruments
g. integrate the use of computers in chemistry education
h. be able to think independently in applying their knowledge to chemical problems
i. be able to take part in research projects and present their findings

- *Indicate how technological skills are incorporated into the program of study.*

Computer technology has played a significant role in supporting the chemistry curriculum. At all levels of the program, students are engaged in the use of computers in their course work. The upper level laboratory courses use instruments that are interfaced with computers. The department has UV-Vis, FT-IR, FT-NIR, AA, fluorescence spectrometers, GC, HPLC and GC-MS that operate using computer software. Students in the program are trained to use these instruments so that they will be competent professionally and successful in graduate school. Teaching in a classroom setting has also been impacted by technology. In the past five years, classrooms in which chemistry courses are taught have been equipped with computers and projectors. This has enabled the instructors to present their lectures using PowerPoint, show simulated chemical demonstrations, draw chemical structures and graphs, and access the internet for other audio visuals, which are pertinent to the lecture material. Also, Rasmol, a computer software program, is used for viewing three-dimensional structures of proteins and nucleic acids. The software is also used for studying enzyme mechanisms. In short, advances in computer technology have enhanced all chemistry courses. Lastly, all chemistry faculty members have web-sites on which they post their course syllabi, lecture notes, assignments/quizzes, and other course materials.

The College of Science has an adequate number of modern computers available for students. Students graduating from the chemistry program are expected to effectively use computers in chemistry applications. These applications include using a computer in writing, drawing chemical structures and data analysis, communicating scientific information, modeling and simulating chemical phenomena, acquiring and processing data, and retrieving information using library or internet resources. Furthermore, students are taught how to give PowerPoint presentations and how to use Excel to perform chemical and statistical calculations.

The program also provides some computer-simulated experiments for the Principle of Chemistry I and II courses. These experiments are introduced to reinforce the student's comprehension of the material discussed in the lecture. The simulations are important because they familiarize students with the actual lab. More importantly, the computer-simulated labs are advantageous in that no chemicals are required, and this minimizes waste.

- *Indicate how the program is relevant to student needs.*

Students who enter our program have diverse backgrounds and goals. Therefore, the department offers three undergraduate programs in chemistry (i.e., BA, BA Ed, and BS). The BA degree is designed for students interested in going to professional schools, such as medical, dental or pharmacy, or for students seeking employment in the field of education, business, quality control, and environmental fields. The courses in the program provided a broad foundation in the field and permit flexibility for evolving and changing students' interests. Several upper level elective courses expose students to modern fields within the chemical sciences and help them to broaden their college experience.

The BA Ed in chemistry is essentially the same as the BA program; however, additional education courses are required to complete the BA Ed program. In addition to the general degree requirements, the BA Ed program requires satisfactory completion of courses in mathematics, physics, and biology, as well as in chemistry and education. The BA Ed in chemistry is designed for students interested in teaching chemistry at the secondary education level, especially to high school students.

The BS degree is designed for students who are interested in going to graduate school for advanced studies in chemistry or would like to start a career working in an industrial or government research laboratory. The BS chemistry degree requires satisfactory completion of advanced mathematics, physics, computer science, as well as chemistry courses, in addition to the general requirements. Similar to the BA program, upper level courses are offered in the BS program to expose students to modern fields of chemistry.

In addition to courses and labs offered to students, both BA and BS students are required to participate in research under the supervision of a faculty member via two courses, Senior Seminar and

Selected Topics in Chemistry. The research work provides students with hands-on experience that students need to compete and succeed in the work force. Although the research project is time-consuming, students gain invaluable experience, while the faculty members remain current in their fields. Students are also invited to attend regional and national scientific meetings and present their research findings. By attending ACS meetings, students can visit job fairs, meet potential employers, and speak with recruiters from different graduate schools.

Over the past three years, we have tracked where our undergraduate chemistry majors go and what they do after graduation. More than half go on to graduate school and others obtain employment in industry or government. The remaining chemistry majors enter health related professional schools or become secondary school chemistry teachers. The department request feedback from employers and graduate schools about the progress of our chemistry graduates. To address the needs of students going for advanced degrees, the department has started offering advanced courses such as Spectroscopic Identification of Organic Compounds and training on use of modern analytical instruments, such as GC, AA, UV-Vis, and HPLC.

- *Describe how students are challenged to think across disciplines.*

Chemistry is the basis of all other sciences, and the knowledge of chemistry is essential to many employment opportunities. The science of chemistry explores the nature of the materials that make up our physical world, why they possess the different properties that characterize them, how their intimate structure may be understood, and how they may be manipulated and changed. Chemistry plays a major role in our civilization, and chemists seek solutions to a variety of questions related to our civilization as related to medicine, food, clothing, and environment. Graduates from the chemistry programs are expected to have understanding of qualitative and quantitative interpretation of data as they relate to scientific problems. They also are expected to be able to think independently, and be able to apply skills and knowledge of chemistry to solve real-world problems.

- *Explain how diversity, multiculturalism, and international perspectives are included in the program.*

Throughout the evolution of chemistry, many scientists of different ethnic backgrounds and nationalities have contributed to its growth. The contributions of all scientists from the time of alchemists to the modern nuclear age are discussed, to some degree, in all courses taught through the program. To this end, different cultures and people are discussed in relation to chemical phenomena and occurrences. Representative examples of topics discussed include: the use of various types of medicinal plants by different cultures in Africa and Asia; modern medicine and diagnosis in the West; the effect of modern civilization on the life-style of the Western Hemisphere people and its consequential environmental effect; global warming; ozone depletion; arsenic poisoning in Bangladesh; and the Chernobyl nuclear disaster. Our chemistry graduates are also encouraged to take a foreign language course so that they can communicate effectively in the competitive multicultural workforce.

- *Describe methods to be pursued for program improvement*.

Although the chemistry program offers a solid background in chemistry to its majors, some modifications in the curriculum can enhance the quality of the various programs. One such modification is to offer a separate physical chemistry course for the BA programs. Currently, students in the BA programs are only required to take one semester of physical chemistry, which has calculus-based physics as a pre-requisite. However, calculus-based physics is only required for the BS program. The requirements of the two programs conflict with each other, and this modification would improve the chemistry program by removing contradiction. Hence, we plan to develop and make available for the BA programs a one semester Physical Chemistry course, which does not require calculus-based physics as a pre-requisite. Also, additional electives are being developed and made available for students in the programs. For example, we plan to offer a course in electrochemistry and develop a second course in advanced inorganic chemistry. Both courses will be offered as electives.

II C. Selectivity, Academic Achievement, and Satisfaction of Students in the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Above Average

- *Describe the characteristics of students in the program.*

  a. Overall GPA
  For all Chemistry majors in 2004/2005, average GPA was 3.1.

  b. Retention Rates
  Retention rate represents first-time full-time undergraduate student cohorts enrolled in the fall semester who entered CSU in the fall or previous summer term. Retention rate data shows a significant rise in the retention rate from cohorts returning for the fall 2004 (70 %) to cohorts returning in fall 2005 (82 %). The retention rate observed in the chemistry program is similar to or exceeds that of the university as a whole.

- *Describe student learning, satisfaction, and evidence of success in meeting student needs and learning outcomes as reflected by major field assessment.*

Students graduating from any of the chemistry programs are required to take the Major Field Assessment Test (MFAT) in chemistry. The MFAT is a national standardized test prepared and graded by Educational Testing Services (ETS). The purpose of the test is to evaluate student knowledge, in their respective fields, during their senior year. Analysis of the MFAT scores from students over past 5 years reveals the quality of the chemistry programs. For instance, the data reveals that our average (142) is consistent and comparable with the national average of 145. This exit examination is used by the department as an in-house device to measure and track departmental progress as it relates to students. Based on the results of the MFAT, chemistry faculty members make changes or modify the contents of the materials presented in their courses.

- *Describe methods to be pursued for program improvement.*

We will continue to assess the curriculum annually using the MFAT and make changes to address any needs revealed by the scores.

II D. The Quality of Faculty Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Above Average

- *Describe the adequacy of faculty and staff to support the program. (locations of graduate training, post-graduate training, specializations, secondary fields)*

The chemistry program is comprised of seven full-time faculty members. Each faculty member has a Ph.D. in one of the major areas of chemistry. The faculty members in the department have many years of teaching and research experience, and their expertise covers all five areas of chemistry (Table II D.1). It is therefore possible to cover all of the sub-disciplines of chemistry that are associated with the BA and

BS degree programs. The chemistry program shares a secretary with the geology program and other disciplines that are part of the Department of Chemistry and Geology. The names of the faculty members in the chemistry program with their education and area of specialization are indicated in Table II D.1.

Table II D.1. Faculty credentials.

Name	**School/Degree/Year**	**Post-Doctoral**	**Specialization**	**Year started**
Anil Banerjee	Indian Institute of Technology, India, Ph.D., 1972	Science Education, Univ. of Iowa, 1991	Physical Chemistry/ Sec. Science Ed	Fall 2005
Rajeev Dabke	University of Pune, India, Ph.D., 1992	U. of California, Riverside 1999-2002	Physical Chemistry/ Electrochemistry	Fall 2002
Zewdu Gebeyehu	Philipps Univ., Marrburg Germany, Ph.D., 1991	Univ. of Illinois, Urbana, 1991-92	Analytical/Inorganic Chemistry	Fall 2002
Floyd R. Jackson	Howard Univ., Washington DC., Ph.D., 1990	-	Inorganic Chemistry	Fall 1997
Charles Lovelette	Rensselaer Polytechnical Institute, USA, Ph.D., 1969	-	Organic Chemistry	Fall 1991
Joseph K. Rugutt	Louisiana State Univ. Ph.D. , 1996	Louisiana State Univ., 1996-99	Organic/Analytical Chemistry	Fall 2006
Paul J. Simon	U. of Georgia, Athens Ph.D., 1998	U. of Georgia, Athens, 1999-01	Biochemistry	Fall 2003

- *Describe the support provided for faculty development*.

The university provides competitive professional development funds that can be used for research or to cover travel expenses to scientific meetings (i.e., conferences, meetings, and workshops). The university periodically trains faculty members on the use of modern computer technologies (e.g., Excel, FrontPage, Web-CT/Vista, and PowerPoint). The support obtained from the university's library is also significant. Although the holdings in the library are scarce, books and journals can be ordered by the library through its interlibrary loan system. The library also provides data bases to scientific literature through GALILEO. Lastly, the library staff occasionally organizes colloquium and group discussions aimed at expanding scientific knowledge of students and faculty members.

- *Show faculty diversity and credentials.*

Table II D.2. Faculty diversity and credentials.

	Caucasian	African American	Asian	Female	Male	Total
Full Time	2 both Ph.D.	3 all Ph.D.	2 both Ph.D.	-	7	7 Ph.D.
Part Time	-	-	1 MS	-	1	1 MS

Table II.D.2 shows the ethnic diversity of the chemistry faculty. Unfortunately, there are no female faculty members in the department, despite the department's many attempts, in recent hires, to recruit female applicants.

- *Describe how part-time faculty are integrated into the program.*

The use of pat-time faculty is minimized in the department. However, the chemistry program operates with one part-time faculty member. The part-time faculty member is a former faculty member who retired from full-time teaching several years ago. His major duty is to teach one lecture section of Survey of Chemistry I and conduct tutorial sessions for the introductory courses (i.e. Survey of Chemistry I and II, and Principles of Chemistry I and II). Since enrollment in introductory courses is increasing, the part-time faculty member will continue teaching.

- *Describe methods to be pursued for program improvement.*

The faculty members presently working in the department are all very well experienced in teaching and research. Their expertise covers all the five areas of chemistry and other secondary areas. This diversity enables the faculty members to give good services to the department as well as to other departments who require offering of chemistry course to their majors. However, with the increasing number of students enrolled in chemistry courses from year to year, we strongly suggest the hiring of an additional faculty member. Considering the lack of gender diversity in our department, we hope that our next ire in the chemistry program will be a well qualified female. Lastly, there is an urgent need to hire a stockroom manager to keep track of the chemicals and glassware. This will also allow faculty to become more productive in scholarly activities.

II E. The Quality of Facilities and Equipment Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Above Average

- *Describe the condition and adequacy of available space.*

The space allocated to the chemistry program is housed in Lenoir Hall. Limited laboratory space is available for research; hence, one faculty uses the prep lab for research space and two others are using reserved spots in the teaching labs (quantitative analysis and physical chemistry) for research, (i.e., room 205). Currently, this does not interfere with classes since the number of students in these advanced level courses is relatively low (6-10). Overall, the building in which the chemistry program is housed is well-maintain and is a pleasant environment to work and study. Space currently assigned to the chemistry programs is listed in Table II E.1.

Table II E.1. Space assigned to the chemistry programs.

Room Number	**Function**
Lenoir Hall 103	Research Lab
Lenoir Hall 109	Office
Lenoir Hall 121	Computer Lab
Lenoir Hall 205	Physical Chemistry Laboratory (Primary), Research Lab
Lenoir Hall 205A	Instrumentation Lab
Lenoir Hall 206	Research lab
Lenoir Hall 206A	Instrumentation Lab

Lenoir Hall 208	Instrumentation Lab
Lenoir Hall 209	Inorganic Chemistry and Quantitative Analysis Lab
Lenoir Hall 210	Office
Lenoir Hall 250A	Office
Lenoir Hall 304	Solvent Room
Lenoir Hall 305	Biochemistry Lab
Lenoir Hall 305A	Cold Room
Lenoir Hall 307	Survey of Chemistry Lab, Biochemistry Lab
Lenoir Hall 308	Chemistry Stock Room
Lenoir Hall 309	General Chemistry Lab
Lenoir Hall 309A	General Chemistry and Survey of Chemistry Balance Room
Lenoir Hall 310	Organic Chemistry Lab
Lenoir Hall 310A	Organic Chemistry prep room, Organic Research
Lenoir Hall 311	Office
Lenoir Hall 312	Office
Lenoir Hall 313	Office
Clearview Hall 103	Office

- *Describe the condition and adequacy of technology labs, equipment, and library resources.*

The chemistry program has accumulated an adequate amount of modern scientific equipment for teaching and/or research. For instance, Lenoir Hall is equipped with twenty four modern Dell computers, which are all connected to the university's server. Students enrolled in introductory, as well as upper division courses, use these computers for data processing, statistical analysis, and writing laboratory reports. In addition to the major equipment listed below in Table II E.2., the chemistry program also has several pH meters (glass and stainless steel), conductivity meters, and rotary evaporators. Unfortunately, the chemistry program does not have a nuclear magnetic resonance spectrometer (NMR). Also, functional fume hoods are in all of the teaching/research labs. Despite some challenges due to budget constraints, the chair has made great efforts to keep the instruments operating through service contracts.

Faculty members and students have access to a variety of on-line services related to current scientific literature, which can be obtained through GALILEO. Some of these services include: General Science Full Texts, Current Contents Connect, Current Contents, Academic Search Premier, and SCIRUS. Faculty and students have access to these data bases from their offices or home. However, we do not have access to CHEM Abstracts, which is one of the major data bases used by chemist to conduct literature searches. Additionally, the library offers an "interlibrary loan" in conjunction with GALILEO, which affords access to scientific literature that is not available in our library. In addition to the interlibrary loan of journal articles, this system also has provisions for obtaining books. The library has maintained a modest collection of current journals, such as, Science and Nature. Currently, there is no database available for chemistry faculty to conduct a literature search on campus. Moreover, the library collection of current journals is inadequate for our current faculty and represents an area for improvement.

Table II E.2. Instruments available in Lenoir Hall for chemistry programs.

Room Number	**Instrument or Software/Model**	**Model Year**
103	Varian Cary Fluorescence Spectrophotometer/Eclipse	1999
103	Shimadzu GC-2010	2005
103	Varian Cary UV-Visible Spectrophotometer/ 100Bio	2001
103	Perkin Elmer Identicheck FT-NIR	2003 (Donation by Bayer)
103	Spartan Molecular Modeling	-

313	CHEMDRAW	-
205	Perkin Elmer FTIR/1600 Series	-
205	Faraday MP Potentiostat	2006
205	Glove Box	-
205	TC12 Tubular Furnace/Mellen Company	2005
205A	Perkin Elmer FTIR/Spectrum One	2005
206A	2 Shimadzu UV-Visible Recording Spectrophotometer	-
206A	Thermo-Finnigan/Ion trap Mass Spec.	-
206A	Shimadzu Atomic Absorption/AA-6701 Flame Emission	-
209	Thermo Electron Corporation Precision Oven	2006
209	VWR 1350G Oven	-
209	Fisher Isotemp Oven/300 Series/350G	-
209	Corning Automatic Collection System for Distilled Water	-
209A	6 Analytical Balances/Fisher ScientificA-250	-
209A	2 Magnetic Susceptibility Balances/Johnson Matthey	2005/1998
210	CHEMDRAW	-
212	Dark Room	-
305	JASCO HPLC/PU289+	2005
305	UV spectrophotometer/Genesys10 Thermoelectron Corp.	2005
305	Labconco Freeze Dryer	2006

- *Provide other indicators of adequacy of campus infrastructure to support the program*.

The Computer Information and Networking Service has provided faculty with the tools to create web-based instruction, (i.e., PowerPoint and/or VISTA/Web-CT) for both introductory and advanced level courses. All faculty members receive full support in the development and construction of web-pages that supplement coursework. Consequently, faculty members are updated on any new developments in web-based instruction. Lastly, all classrooms are equipped with state-of-the-art technology for teaching.

- *Describe methods to be pursued for program improvement*.

a. The library resources (electronic data bases, journals, and reference books) must increase as we plan for ACS approval of the BS program.
b. Seek funding for the acquisition of a nuclear magnetic resonance (NMR) spectroscopy instrument. An NMR instrument is required for ACS approval.
c. We plan to strategically use lab fee money to maintain glassware and the purchase of smaller instruments that are vital to the chemistry programs.
d. With an ever increasing enrollment, more lab space is required.

II F. The Quality of Research and Scholarship Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Satisfactory

- *Explain how faculty involve students in research.*

All faculty members are research oriented and have on-going research projects. Students in any of the chemistry programs must take two research courses (CHEM 4795 and CHEM 4796) for the completion of the degree. The Senior Seminar courses, CHEM 4795 and CHEM 4796, are required in all chemistry programs. Also, students can engage in research by taking an Independent Study course (CHEM 4899). CHEM 4899 is offered as an elective and it affords additional opportunities for students to continue research with their advisor for academic credit.

- *Describe how faculty research relates to the program mission.*

The department of chemistry is guided by CSU's mission statements including: "Meeting the academic, social, cultural, and health needs of students through co-curricular activities, student services, and a strong academic advisement program; fostering the cultural, ethnic, racial, and gender diversity of students, faculty, and staff." Chemistry faculty research augments this mission in many ways. Research provides an avenue for faculty to be excellent teachers by staying current in their respective fields. Besides, student-faculty research is one of the key requirements for ACS accreditation.

- *Describe mentoring and professional development opportunities for faculty.*

The College of Science has developed a detailed plan for mentoring and professional development opportunities for science faculty. Each new faculty member is assigned a mentor from among the more established tenured faculty. The mentors offer advice and guidance as the new faculty members work to establish a body of accomplishments that will allow them to apply for promotion and tenure.

The Department of Chemistry and Geology devotes a modest part of its operational budget to professional development of faculty. Each year, faculty member may attend at least one ACS meeting per year. ACS meetings are excellent avenues for chemists to learn new research/teaching skills and network with colleagues in research I universities, government labs, and industries.

- *List faculty publications, papers given, and public lectures.*

<u>Publications:</u>

1. Roth, K. M.; Yasseri, A. A.; Liu, Zhiming; <u>Dabke, R. B</u>.; Malinovskii, V.; Karl-Heinz Schweikart, K-H.; Yu, L, Tiznado, H.; Zaera, F.;Lindsey, J. S.; Kuhr, W. G.; Bocian, D. Measurements of Electron-Transfer Rates of Charge Storage Molecular Monolayers on Si(100). Towards Hybrid Molecular/Semiconductor Information Storage Devices. *J. Am. Chem. So*c. (2003), *125*, 505-517.
2. Kristian M.; <u>Dabke, R. B</u>.; Liu, Zhiming; Yasseri, Amir; Gryko, D. T.; Clausen, Christian; Lindsey, Jonathan S.; Bocian, David, F.; Kuhr, W, G. Charge-Retention Characteristics of Self-Assembled Monolayers of "Molecular-Wire" Linked Porphyrins on Gold Roth. *ACS Symp.* Series (2002) vol. *844*.
3. Li, Q.; Mathur, G.; Homsi, M.; Surthi, S.; Misra, V.; Malinovskii, V.; Schweikart, K-H.; Yu, L.; Lindsey, J. S.; Liu, Z.; <u>Dabke, R. B</u>.; Yasseri, A.; Bocian, D. F.; Kuhr, W. G. Capacitance and Conductance Characterization of Ferrocene-Containing Self-Assembled Monolayers on Silicon Surfaces for Memory Applications. *App. Phys. Lett.* (2002), *81*, 1494-1496.
4. Ellene Kebede, Jianbang Gan and <u>Zewdu Gebeyehu</u>, "*Non-Point Source Pollution and Land Use Pattern Linkage: A Watershed Approach*" Journal of the Alabama Academy of Science, Vol. 74, Nos.3/4, July/October 2003.
5. Brilla, C., Josefsberg, R., Sochan, J., Gilbert, M., Taylor, E., Sellers, B., <u>Rugutt, J. K</u>., Frazier, M. C., Davis, J., and Keller, T. A. Bioassay-Guided Isolation and Synthesis of Chiral Bioactive Agents from Kenyan Plants, In preparation, 2006.
6. <u>Joseph K. Rugutt</u> and Kipngeno J. Rugutt. *In Vitro* Activity of Natural and Synthetic Compounds Against Mycobacteria. In Press, 2006.
7. <u>Joseph K. Rugutt</u>, Anastasiah N. Ngigi, and Paul K. Ndalut. Evaluation of Natural Products as Possible Alternatives to Methyl Bromide in Soil Fumigation. In Press, 2006.
8. <u>Joseph K. Rugutt</u>. Merry-go-round Mentoring. *Chemical & Engineering News, 81*, 6, 2003

Papers Given:

1. A.C. Banerjee: A professional development program for high school chemistry teachers on inquiry teaching, accepted to the 58th Southeast Regional Meeting of American Chemical Society, SERMACS 2006, Augusta (November 1-4, 2006).
2. A.C. Banerjee: Freshman teaching freshman: a peer-tutoring project to enhance student learning in freshman college chemistry, accepted to the 58th Southeast Regional Meeting of American Chemical Society, SERMACS 2006, Augusta (November 1-4, 2006).
3. A.C. Banerjee: Student learning and retention in a core course on survey of chemistry, presented at the American Chemical Society National Meeting, Atlanta, March 26-30 (2006).
4. A.C. Banerjee: Collaborative professional development for high school chemistry teachers, presented in the Division of Chemical Education, 229th ACS National Meeting, San Diego, CA, March 13-17, 2005.
5. A.C. Banerjee, Dipankar Koley and Ekua Okoso-Amaa: Low-temperature catalytic oxidation of CO over silica-supported palladium catalysts, presented in the Division of Fuel Chemistry, 229th ACS National Meeting, San Diego, CA, March 13-17, 2005.
6. A.C. Banerjee, Dipankar Koley, Ekua Okoso-Amaa, Patricia Thomas: Catalytic oxidation of carbon monoxide: Effect of drying methods on activity and FTIR spectra, accepted for the North American Catalysis Society,19th North American Meeting, Philadelphia May 22-27, 2005.
7. A.C. Banerjee: Teaching a graduate course on chemistry methods to high school chemistry teachers for conceptual development and inquiry: Paper presented at the Annual Conference of the National Association for Research in Science Teaching (NARST), Dallas, Texas, April 4-7, 2005.
8. A.C. Banerjee: A professional development program for high school chemistry teachers, paper accepted for presentation at the AETS International Conference, Colorado Springs, CO, January 19 - 23, 2005).
9. Poster Presentation on the meeting of The Electrochemical Society "Non-aqueous Electrophoretic Deposition of Aluminum Nitride from its Suspension in Acetyl Acetone" Bizuneh Workie, Brian McCandless and Zewdu Gebeyehu, May 7-12, 2006, Denver, Colorado.
10. Poster Presentation on the meeting of The Electrochemical Society "Effects of Various Factors on the Amount of AlN Coated in Electrophoretic Deposition of Aluminum Nitride from its Suspension in Acetyl Acetone " Bizuneh Workie, Brian McCandless and Zewdu Gebeyehu, May 7-12, 2006, Denver, Colorado.
11. Poster Presentation on Georgia Academy of Science meeting "Synthesis, characterization and luminescence studies of lanthanide (III) complexes" Zewdu Gebeyehu and Hirofumi Motegi, March 2005.
12. Rugutt, J. K. Tilton School, NH. Title of Poster: Isolation and Synthesis of Antimycobacterial Agents from African Plants; (ii) Medicinal Chemistry, August 7-12th, 2005.
13. Rugutt, J. K. attended a Shimadzu-sponsored Biotech Seminar title: *Integrated Tools and Technology for Proteomics and the Life Sciences* at the *"Pulse"* of RTP: Charles Hamner Conference Center North Carolina Biotechnology, NC; November 22, 2004.

- *Describe methods to be pursued for program improvement*.

The chemistry faculty members strongly suggest that the College of Science provide funding for the purchase of new equipment to support undergraduate research and teaching.

II G. The Quality of Service Supporting the Program

State your assessment of the strength of the evidence of program quality on this indicator.
Above Average

- *Describe projects completed and outcomes which contribute to the program, department, college, institution, community, and/or the region.*

The faculty members in the chemistry program serve on various committees at the departmental, College of Science and University levels. Some faculty members serve on outside committees at the regional and national levels. Faculty members also provided service as judges and committee members at the Regional Science Olympiad Tournaments and the Columbus Regional Science Fairs that are held at CSU. A recently funded project on professional development of chemistry teachers includes school visits by chemistry faculty members, chemistry demonstrations, and model inquiry teaching in high school classes at Muscogee and Harris County schools.

- *Describe methods to be pursued for program improvement.*

The faculty members in the chemistry program are aiming at more active participation in college-wide activities and community outreach programs.

II H. Program Honors & Awards

- *Identify the formal honors, awards, high rankings, citations of excellence, accreditations, positive external reviews, etc. that this degree program has received over the last seven years*.

The last Comprehensive Program Review assessment in 2002 gave excellent ratings for the chemistry program. Also, the report prepared by SACS in 2005 gave a favorable rating**.**

- *If program accreditation is available but has not been attained at CSU, explain why*.

Accreditation is available to our programs through the ACS; however, the chemistry program is not approved by the ACS. There are several criteria that have prevented our program from being approved. The major requirements for ACS approval are having a nuclear magnetic resonance (NMR) spectrometer, having appropriate library journals, and having an autonomous department (i.e. having a separate departmental budget from the other disciplines within our department, which houses several other sciences). One of our major plans is to seek ACS approval of the chemistry program. However, we will need full support of the university administration for this to be accomplished. The help that we will need is financial support to 1) acquire the appropriate number of journals in the library and 2) establish a department of chemistry, which is decoupled from the other science disciplines that are currently a part of our department.

II I. Exceptional Achievements and Honors of the Program's Students, Graduates and Faculty

- *Identify the exceptional achievements and honors received by the program's students, graduates, and faculty over the past five years which reflect on the quality of the program*.

Students, as well as faculty members, of the department have been awarded prizes, appointed in different organizations, or granted support.

Students:

a. Julio Gutierrez received a summer research internship at the University of Tennessee (UT) during the summer of 2002; awarded admission to graduate school at UT in 2004.

b. Hirofumi Motegi, obtained a prize of $100 from Georgia Academy of Science, winning first place after presenting a poster titled "Synthesis, Characterization and luminescence studies of lanthanide (III) Complexes" in March 2005; awarded admission to graduate school at VA-Tech in 2005.

c. Hunter Champion received a summer research internship at Virginia Tech. during the summer of 2004; awarded admission to graduate school at VA-Tech in 2006.

d. Jane Skalski received summer research internship positions at Virginia Tech during the summers of 2005 and 2006.

Faculty:

a. Dr. Anil Banerjee
-Appointed as member of Editorial Board, Journal of Research in Science Teaching (2002-2006)

-Appointed as External Examiner of two Ph.D. Thesis in Science Education from Curtin University and Edith Cowan University, Australia (2003 and 2004)

-Appointed as Chemistry Expert Panel Member, American Board for Certification of Teacher Excellence (2006)

b. Dr. Zewdu Gebeyehu
-Obtained summer research support from The National Research Council (NRC) for the summer of 2003 to work at Wright-Patterson Air Force Base (WPAFB).

c. Dr. Joseph K. Rugutt
- Is the PI in NSF Grant # 0619431, "Acquisition of a Capillary Electrophoresis System for Enhancing Research and Education at Claflin University". Funding Period: 08/09/2006-08/09/2009. Funding amount: $53,225.

- Is the Co-PI in NSF Grant # 0625028, "Targeted Infusion Grant - Enhancing Research Infrastructure in Chemistry at Claflin University". Funding Period: 07/25/06-12/31/07. Funding amount: $155,000.

II J. General Success of the Program's Graduates

- *Report the results of the department's assessments of the general success of the program's graduates such as licensure or certification rates, job offers, job placement statistics, average salaries, subsequent career advancement, test scores, admissions to post-baccalaureate programs, etc.*

Over the past five years, most of our graduates have continued their education by pursuing advanced degrees in chemistry at major Ph.D. granting institutions. We currently have former students enrolled in graduate school at The University of Georgia (1), Saint Louis University (1), Louisiana State University (1), Virginia Tech (2), Iowa State University (1), and The University of Tennessee (1). However, those who elected to start their career have obtained positions as chemist in the local chemical industry and government labs. Currently, we have graduates employed at Cott Beverage, Pratt and Whitney, and Georgia Bureau of Investigation. Nevertheless, we do not have a mechanism for tracking our graduates' post-baccalaureate careers in the detail required to address these issues adequately. Hence, we are willing to implement an exit survey for use by an Office of Institutional Effectiveness, which focuses on student satisfaction and success.

II K. Stakeholder Satisfaction with the Program

- *Report the results of surveys of students, alumni, employers, community partners, etc. concerning their satisfaction with the quality of the program and its learning experiences and any program improvements initiated as a function of such feedback over time.*

Graduates and employers in the area often comment on the quality of the work that our graduates provide. However, we do not have formal data to support these findings. Several students have expressed their satisfaction with our chemistry program. Among these, are comments of a couple of recent graduates who are pursuing their Ph.D. in chemistry.

> "… I just wanted to say thank you for all the preparations that I needed for grad school, especially for physical inorganic chemistry. ….I have chosen my graduate advisor whose group is doing something similar to what I did before at CSU so I'll have a good start anyways….Between you and I, not every grad student seems to be capable of Ph.D. status. I think I am, though, and it's because of you and others."
>
> Hunter Champion

> "…..I just need to make myself more to think positively and seriously than any other students because you opened my door to the chemistry research and taught me how the graduate school is like. I do really respect you as my great professor and as a great adviser in my life…."
>
> Hirofumi Motegi

- *Also comment on the effectiveness of the program's use of a community advisory board.*

Currently, we do not have a community advisory board; therefore we cannot address this topic sufficiently. However, we are willing to investigate the possibility of establishing an advisory board as it relates to increasing the productivity of graduates in the chemistry program.

II L. Program's Responsiveness to Change & Improvement

- *Cite the most significant examples of improvements made in the program over the last seven years in response to changing conditions, new external requirements, and/or departmental assessment initiatives.*

Over the past five years the chemistry program has made several changes to improve the quality of the program and its graduates. The most significant changes that have affected the chemistry programs are as follows:

a. students must receive a grade of "C" or better in all chemistry courses as this is a pre-requisite requirement for all sequential and upper division courses
b. an increase in the number of full-time faculty from four to seven
c. the acquisition of new instrumentation for teaching and/or research (see Table II. E.2 on page 9 and 10 for instrumentation in the department)
d. offering the BA Ed degree to students who wish to pursue teaching chemistry as a career

The significance of the B.A. and Secondary Education program is that it is the only program of its kind in the entire region and one of few in the state.

- *Comment on how frequently the program's faculty is engaged in program assessment activities, comprehensive program evaluations, and fine tuning of the program and its requirements*.

At the end of each academic year, faculty members in the chemistry program meet to discuss issues surrounding the productivity, accomplishments, and failures of the program. The findings at this end-of-year meeting are revisited at the first meeting of the next academic year in order to ensure that history is not repeated and progress is made.

III. Summary Findings of the Program's Overall Productivity

Repeat the summary conclusion about the strength of the program's overall productivity as reported in the executive summary and cite any additional detailed analyses, interpretations, or rationale that support this summary judgment. This summary conclusion should be consistent with the pattern of strengths and weaknesses observed among the indicators of program productivity that follow.

a. There is an increase in enrollment of upper division chemistry majors.
b. Chemistry graduates get employment in local industrial labs, some students pursue graduate studies in respectable universities and institutions
c. The faculty members in the department are making sustained efforts to increase enrollment, retention and number of students graduating in chemistry.
d. Minority students are well represented in the chemistry program.
e. Ethnically diverse chemistry faculty members are important role models.

III A. Enrollment of Students in the Program

State your assessment of the strength of the evidence of program productivity on this indicator.
Satisfactory

- *Analyze and interpret the numbers of enrolled upper division majors in the program and the enrollment trends of these majors for the past five years*.

Table III A.1 shows enrollment of chemistry majors in upper division chemistry courses during the 2003-2006 academic years. The data indicates that enrollment of upper division chemistry majors increased by 54 % from 2003 to 2006.

Table III A.1. Enrollment of chemistry majors in upper division chemistry.

2003/2004	2004/2005	2005/2006	3-year average
13	16	20	13

Another good indicator of the program's overall productivity is the increased enrollment of chemistry majors from 2004 to 2006. This data is illustrated in Table III A.2.

Table III A.2. Enrollment of chemistry majors during 2004-2006.

Fall 2004	Fall 2005	Fall 2006	3-year Average
60	77	90	76

- *Compare the strength of the numbers of the upper division majors and enrollment trends for this program with the enrollments and trends of upper division declared majors in other undergraduate programs at CSU.*

Comparison of the three-year (fiscal) average of chemistry upper division majors with other undergraduate majors at CSU indicates that chemistry ranks 33rd out of 41 programs (CSU average upper division enrollment majors: 58)

- *Describe methods to be pursued for program improvement.*

The faculty members are actively engaged in increasing the chemistry major enrollment through recruiting, performing chemistry demonstrations, and advising student. Another major initiative on recruiting chemistry majors is through a recent Federal Teacher Quality project grant on professional development of chemistry and physical science teachers. This project links local area high schools with the chemistry faculty at CSU. We plan to continue these efforts for the next five years and beyond.

III B. Annual Degree Productivity of the Program

State your assessment of the strength of the evidence of program productivity on this indicator.
<u>Satisfactory</u>

- *Analyze and interpret the numbers of degrees granted annually (fiscal year) by this program and the trends of the program's degree productivity over the past five years.*

The data on baccalaureate degrees awarded between 2001and 2005 in chemistry and related science and mathematics programs are presented Table III B.

Table III B. Baccalaureate degree awarded between 2001and 2005.

Baccalaureate	2001FY	2002 FY	2003 FY	2004FY	2005 FY
Chemistry	4	4	0	4	4
Geology	0	1	0	4	2
Mathematics	5	3	2	0	5
Biology	16	11	24	17	25

- *Compare the strength of the degree productivity of this program with the productivity of other undergraduate programs at CSU.*

The number of students graduating with a BS and BA degrees in chemistry remained somewhat steady over a period of four years. The graduation number is better than BS in geology and is comparable to BA and BS degrees awarded in mathematics.

- *Describe methods to be pursued for program improvement.*

The faculty members in the department are making sustained efforts to increase enrollment, retention and number of students graduating in chemistry. The chemistry faculty members are planning to apply for ACS accreditation. This involves writing proposal for submission to NSF for an NMR spectrometer, subscribing to leading ACS journals and setting-up SciFinder network for the campus-wide use. The chemistry faculty members are planning to organize science-fair projects and chemistry demonstrations for high school students.

III C. Program Completion Efficiency and Graduation Rate

State your assessment of the strength of the evidence of program productivity on this indicator.
Satisfactory

- *Analyze and interpret the program's graduation rate.*

The cohorts in Table III C are first-time full-time undergraduate students enrolled in the chemistry baccalaureate program fall semester who entered CSU in the fall or the preceding summer term.

Table III C. Six-year graduation rates for chemistry majors.

Fall 1999 Cohort	Fall 1999 Cohort Graduating by 2005		Fall 2000 Cohort	Fall 2000 Cohort Graduating by 2006	
Number	Number	Rate	Number	Number	Rate
8	2	25.0%	4	2	50.0%

- *Compare the program's graduation rate with those of the other undergraduate programs at CSU and offer possible explanations for this program's unusually high or low graduation rate if applicable.*

The fall 2000 cohort six-year graduation rate in chemistry is the third highest graduation rate among 40 major programs at CSU.

- *Describe methods to be pursued for program improvement.*

To improve retention and graduation rates, services such as tutoring and mentoring will be enhanced. We will also engage the entire faculty in an intensive recruiting effort.

III D. Efficiency and Clarity of the Program's Course Requirements

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *Analyze the published course requirements for program completion in terms of the simplicity and efficiency of the program's curricular design and the degree to which program requirements are communicated clearly and effectively.*

The published course requirements, as stated in the CSU catalog, are clearly written for each program. All pre-requisites are stated without ambiguity. The catalog is available as a hard bound copy and also on the internet. In addition, the department has available degree progress sheets for students in the various programs, and these are used by the faculty during advising.

- *Comment on the ease with which majors understand and successfully navigate through the required curriculum for program completion.*

Students in the chemistry programs are able to map out the courses they need to take with relative ease. However, they are guided by their academic advisor to ensure that they progress according to the design of the program's curriculum. All of the chemistry faculty members serve as academic advisors to the students.

- *Describe methods to be pursued for program improvement*.

There are some minor adjustments that the chemistry programs need to make them more efficient. The following are initiatives that we will address and utilize to bring clarity to the program's curriculum.

a. develop additional upper division chemistry courses to offer as electives
b. revise the curriculum for the BA and BA Ed

III E. Frequency and Sequencing of Course Offerings Required for Program Completion

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *Analyze and interpret the scheduling and enrollment history of courses required for program completion, giving particular focus to the regularity, frequency, and sequencing of course offerings required for program completion*.

The scheduling, as displayed in Table III E, is arranged to offer the sequential courses (like Chem. 1211/1212, 3111/3112, 4111/4112) in fall and spring semesters. Upper level chemistry courses are offered in either fall or spring semesters.

Table III E. Frequency of Course Offerings.

Course	Fall	Spring	Summer
CHEM 1211 Principles of Chemistry 1	X		X
CHEM 1211L Principles of Chemistry Lab 1	X		X
CHEM 1212 Principles of Chemistry 2		X	X
CHEM 1212L Principles of Chemistry Lab 2		X	X
CHEM 2115 Quantitative Chemical Analysis	X		
CHEM 2315 Quantitative Chemical Analysis Lab	X		
CHEM 3111 Organic Chemistry 1	X		
CHEM 3311 Organic Chemistry Lab 1	X		
CHEM 3112 Organic Chemistry 2		X	
CHEM 3312 Organic Chemistry Lab 2		X	
CHEM 3135 Inorganic Chemistry	X		
CHEM 3335 Inorganic Chemistry Lab	X		
CHEM 3141 Biochemistry 1	X		
CHEM 3345 Biochemistry Lab	X		
CHEM 3142 Biochemistry 2		X	
CHEM 4111 Physical Chemistry 1	X		
CHEM 4311 Physical Chemistry Lab 1	X		
CHEM 4112 Physical Chemistry 2		X	
CHEM 4312 Physical Chemistry Lab 2		X	
CHEM 4175 Instru. Meth. of Chem. Anal.		X	
CHEM 4375 Instru. Meth. of Chem. Anal. Lab		X	
CHEM 4795 Senior Seminar 1	X		

CHEM 4796	Senior Seminar 2		X	
CHEM 4899	Independent Study	X	X	
CHEM 5115	Spec. Ident. of Org. Compounds	X		
CHEM 5555	Selected Topics in Chemistry	X	X	

- *Describe methods to be pursued for program improvement*.

Although the department is very strong in this area, we will continue fine-tuning the frequency of course offerings as the need arises. Additional sequential course offerings will be considered if additional faculty members are hired or if a chemistry graduate program is launched.

III F. Enrollment in the Program's Required Courses

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *Analyze and interpret the strength of the enrollments in the courses required for program completion*

Enrollment in chemistry courses over a period of five years starting from fall 2002 and the yearly average over the five year period is given in Table III F. The enrollment in the first major-related core course in Principles of Chemistry 1 (CHEM 1211) has been consistent over the last five years.

Table III F. Frequency of course offerings.

Course	**Fall '02**	**SP '03**	**Fall '03**	**SP '04**	**Fall '04**	**SP '05**	**Fall '05**	**SP '06**	**Fall '06**	**Yrly av in 5 yr**
CHEM 1211 Principles of Chemistry 1	122	46	109	x	121	x	121	x	121	128
CHEM 1211L Principles of Chemistry Lab 1	105	31	104	x	104	x	98	x	121	112
CHEM 1212 Principles of Chemistry 2	x	63	26	54	x	54	x	79	x	55
CHEM1212L Principles of Chemistry Lab 2	x	52	18	51	x	47	x	72	x	48
CHEM 2115 Quantitative Analysis	8	x	9	x	6	x	9	x	8	8
CHEM2315 Quantitative Analysis Lab	8	x	8	x	6	x	8	x	7	7
CHEM 3111 Organic Chemistry 1	54	x	53	x	51	x	47	x	56	52
CHEM 3311 Organic Chemistry Lab 1	49	x	50	x	49	x	43	x	54	49
CHEM 3112 Organic Chemistry 2	x	42	x	54	x	51	x	43	x	46
CHEM 3312 Organic Chemistry Lab 2	x	41	x	54	x	48	x	40	x	46
CHEM 3135 Inorganic Chemistry	6		7	x	8	x	8	x	9	8
CHEM 3335 Inorganic Chemistry Lab	6		7	x	7	x	7	x	8	7

CHEM 3141 Biochemistry 1	14	x	14	7	28	x	21	x	19	21
CHEM 3345 Biochemistry Lab	x	x	0	6	9	0	7	x	7	6
CHEM 3142 Biochemistry 2	x	x	x	x	x	9	x	4	x	3
CHEM 4111 Physical Chemistry 1	5	x	5	x	5	x	3	x	5	5
CHEM 4311 Physical Chemistry Lab 1	5	x	5	x	5	x	3	x	5	5
CHEM 4112 Physical Chemistry 2	x	3	x	4	x	6	x	2	x	4
CHEM 4312 Physical Chemistry Lab 2	x	3	x	4	x	6	x	2	x	4
CHEM 4175 Instrumental. Meth.Chem. Analysis.	x	2	x	4	x	4	x	4	x	3
CHEM 4375 Instrumental. Meth.Chem. Anal. Lab	x	3	x	4	x	4	x	4	x	3
CHEM 4795 Senior Seminar 1	2	2	3	1	4	1	3	1	2	4
CHEM 4796 Senior Seminar 2	x	2	1	3	1	3	1	3	1	3
CHEM 4899 Independent Study	1	4	2	3	4	4	5	5	3	6
CHEM 5115 Spec. Ident. of Org. Compounds	0	x	4	x	7	x	4	x	4	4
CHEM 5555 Selected Topics in Chemistry	0	4	x	9	x	1		4	1	4

SP: Spring semester; x not offered

- *Comment on differences between core and elective course enrollments as well as differences among courses required for optional tracks or concentrations. Identify any required courses that are dropped from the schedule of classes frequently due to low enrollment and which majors must complete through approved substitutions or directed studies*

There is a large drop (57 %) in the enrollment in Principles of Chemistry II (CHEM 1212), the next sequential major-related core course after Principles of Chemistry I (CHEM 1211). The reason for large drop in enrollment in CHEM 1212 is mainly due to low passing rate in CHEM 1211. The low passing rate in Principles of Chemistry is mainly due to inadequate high school level preparation. We have identified this as an area of weakness and efforts are being made by the faculty teaching these courses to help students through additional tutorial classes. We would like to institutionalize this need through training of upper level chemistry majors as tutors for freshman chemistry courses. The area F chemistry courses along with the corresponding labs (CHEM 1211/1212 and CHEM 3111/3112) are taken by chemistry, geology, and biology majors. The alarming drop in enrollment starts with the first Area G chemistry program required course CHEM 2115 (Quantitative Analysis) and this more or less reflects the actual majors in chemistry. The average enrollment in this course over the last five year period is eight students in one academic year and this trend in enrollment is also similar for other sequential chemistry courses. This low enrollment in the upper level chemistry courses is one of the main reasons for low graduation rate in chemistry.

- *Describe methods to be pursued for program improvement.*

We have identified the low enrollment in upper level chemistry courses as a major area of weakness and have plans to improve. The improvement plan includes a major drive to increase enrollment of chemistry majors through active collaboration of area high school chemistry teachers and also retention of freshman chemistry majors in the program through tutorial, freshman seminar, chemistry club, and other academic programs.

III G. Diversity of the Program's Majors and Graduates

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *Analyze and interpret the gender, ethnicity, nationality, and age of the upper division majors and graduates in the program.*

The data in Tables III G.1-3 reveals that the number of minority students has increased.

Table III G.1. Fall semester undergraduate chemistry majors by gender.

	2003/04	2004/05	2005/06	3-Year Average
Female	22	30	36	29
Male	17	21	28	22
Total	39	51	64	51

Table III G.2. Fall semester undergraduate chemistry majors by ethnic origin.

	2003/04	2004/05	2005/06	3-Year Average
International Students	3	3	3	3
Asian	4	5	4	4
Black	8	11	22	14
Hispanic	2	3	2	2
American Indian	0	0	1	0
Multi-Racial	1	4	4	3
White	21	25	28	25
Total	39	51	64	51

Table III G.3. Fall semester undergraduate chemistry majors by Age.

	2003/04	2004/05	2005/06	3-Year Average
Under 21	20	29	36	28
21-25	15	18	21	18
26-30	2	3	5	3
31-40	2	1	1	1
41-50	0	0	1	0
51-60	0	0	0	0
Over 60	0	0	0	0
Total	39	51	64	51

Table III G.4. Number of chemistry graduates by ethnic origin.

	2003/04	2004/05	2005/06	3-Year Average
International Students	1	1	0	1
Asian	0	0	1	0
Black	1	0	1	1
Hispanic	0	0	1	0
American Indian	0	0	0	0
Multi-Racial	1	0	0	0
White	1	3	3	2
Total	4	4	6	5

- *Comment on the program's success and distinctiveness in enrolling and graduating a diverse mix of students.*

The ethnically diverse chemistry faculty is a great strength. The department has been successful in training undergraduate students. We have a strong program that helps women and minorities become scientists. We make every effort within our means to assist all students that enroll in the chemistry program.

- *Describe methods to be pursued for program improvement.*

We always seek ways to improve diversity in the chemistry program. The faculty members will continue recruiting students from diverse populations.

III H. Cost-Effectiveness of Instructional Delivery in the Program's Home Department

State your assessment of the strength of the evidence of program productivity on this indicator.
Above average

- *Contrast the instructional cost-effectiveness of this program's home department with other at CSU.*

The Department of Chemistry and Geology has a lower instructional cost per credit hour compared to the average cost per credit hour at CSU. The cost per credit hour of the department for the last three academic years (2003-2006) was \$146, \$137 and \$159 where as for CSU during the same period of time was \$160, \$162 and \$170. The results show that the department runs its program at a lower average cost of \$148/hr, compared to \$164/hr for CSU.

- *List the principal factors that cause this program's home department appear to be unusually cost-effective (i.e., have a low ratio of instructional expenses per weighted credit hour of instruction) or appear to be unusually costly (i.e., have a high cost per credit hour).*

The major factor for the departments lower cost per hour is the large number of students enrolled for chemistry courses, particularly at the lower level. There are larger numbers of students enrolled in lower level courses and this reduces the cost per hour. Over the past several years, the numbers of students enrolled in lower level courses continues to increase. Although the numbers of students has increased significantly, the number of new faculty to compensate for the increase has been gradual.

- *Comment on the degree to which this program contributes to or detracts from the cost-effectiveness of the department.*

The chemistry program significantly contributes in lowering the cost of the department, as well as, that of the university.

- *Describe methods to be pursued for program improvement.*

An increase in the number of students enrolled in upper division courses, as well as further increasing the number of students at lower levels, will increase the cost effectiveness.

III I. Program Responsiveness to State Needs and Employer Demand for Program Graduates

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *Comment on the demand for graduates of this program, followed by an assessment of the program's success in responding productively to such need and demand.*

The chemistry enterprise plays a central role in our nation's well-being and the knowledge of chemistry is essential in many careers ranging from hazardous waste management to development of new materials. In the last five years, the demand for our chemistry graduates has increased dramatically in Columbus area. Soon after graduation, our students are employed as entry level chemists in the local industries such as Cott Beverages USA and Columbus Water Works. The local high schools also have high demand for our chemistry graduates with teacher certification. Still, many of our chemistry graduates pursue Ph.D. studies in nationally recognized graduate programs in chemistry and few go to professional schools, such as pharmacy, dental and medical schools.

The program's success is measured by the response obtained from employers and the performance of students in professional and graduate school programs. Two of our chemistry graduates, Mr. Sam G. Khoury and Miss Joanie Isom are employed at the local Cott Beverage USA. Mr. Khoury is the technical service manager and Miss Joanie Isom is a lab tech under his supervision. They have distinguished themselves as the most qualified employees of the company. Similarly, our graduates in Ph.D. programs are excelling in course work and research. Also, two of our students (Hirofumi Motegi and Champion Hunter) who recently joined the Virginia Tech are doing very well in their graduate studies.

- *List the factors that limit the program's ability to be more productive and responsive to these needs and demands.*

Although our program is progressing in the right direction, there are a few problems that hinder our productivity. The lack of students interested in majoring in chemistry is a major factor for not having many chemistry graduates. Another factor which limits the productivity of chemistry graduates is the high student to professor ratio in lower level courses. Another factor which is affecting the program indirectly is funding to support student assistants. We believe that working as a student assistant gives the students experience that cannot be taught in a classroom setting and is a vital part of their education.

- *Describe methods to be pursued for program improvement.*

The productivity of the program can be improved by aggressively recruiting students to major in chemistry. Hiring an additional faculty member will reduce the student to faculty ratio thereby making the teaching and learning process more attractive to students. We will strengthen the collaborations with local industries and government labs. Moreover, office and laboratory spaces for teaching and research should be given high priorities when planning for future constructions of buildings. We recommend additional funding for the program to hire a sufficient number of student assistants.

III J. Position of the Program's Annual Degree Productivity among Comparable USG Programs

State your assessment of the strength of the evidence of program productivity on this indicator.
Satisfactory

- *Identify the ranking of this program relative to comparable programs in the University System of Georgia (or region or nation) in terms of the number of degrees granted annually.*

Among comparable chemistry programs at University System of Georgia (USG) institutions, our chemistry program ranks last (along with Albany State) in chemistry degrees awarded based upon a 3-year average.

Table III J. Baccaluareate degrees awarded in chemistry at USG institutions.

USG Institution	2003/2004	2004/2005	2005/2006	3-Year Avg
Albany State University	3	1	5	3
Armstrong Atlantic State University	11	10	10	NA
Augusta State University	3	2	8	4
Clayton College & State University	NA	NA	NA	NA
Columbus State University	0	4	4	3
Fort Valley State University	6	4	2	4
Georgia College & State University	8	2	9	NA
Georgia Southern University	10	26	22	19
Georgia Southwestern State University	9	4	4	NA
Kennesaw State University	16	15	27	19
North Georgia College & State University	9	12	4	8
Savannah State University	3	2	2	NA
Southern Polytechnic State University	NA	NA	NA	NA
State University of West Georgia	14	15	14	NA
Valdosta State University	5	7	5	6
Total	97	104	116	106

- *Describe methods to be pursued for program improvement.*

To increase our productivity, we have introduced a peer-led tutoring program at the freshman and sophomore levels. We believe that this will aid in retention since the introductory courses tend to function as 'gate-keepers". We also have initiated a plan to become approved by the American Chemical Society (ACS). Approval by the ACS is the highest award that a chemistry program can attain. ACS approval would be more attractive to high school students during our recruiting visits. An ACS approved program would also be more attractive entering freshman, thereby increasing the number of majors. As a part of our strategic plan, we now offer the BA and BA Ed degrees. Again, we believe that this will increase the number of majors in our programs. Lastly, we plan to aggressively seek funding to support our education outreach since we are one of few universities in the state who provide the BA Ed degree. We also plan to apply for federal funding to support research to engage undergraduate students. This will also serve as tool to increase the number of majors in the department.

III K. This Program's Contribution to Achieving CSU's Mission

State your assessment of the strength of the evidence of program productivity on this indicator.
Very Strong

- *List the substantive contributions this program makes to the achievement of CSU's published statement of institutional mission.*

The chemistry program helps to meet the mission of CSU by offering students a chance to earn a baccalaureate degree with special interests in the BA, BA Ed, or B.S. degrees. Therefore, in the context of the mission statement of the university to "promote educational, economic, social and cultural growth in Georgia and beyond", the chemistry program satisfies the mission by offering variable baccalaureate degrees. Accordingly, students completing one of the chemistry programs are able to compete in the global economic environment. In addition to offering variable baccalaureate degrees, chemistry supports the core curriculum by offering a selection of introductory chemistry courses each semester. Students completing the BA or BS program are prepared to enter graduate or professional school. Consequently, many students who complete program either remain in the local area with employment or they return after completing an advance degree. However, students completing the BA Ed also remain in the region to teach chemistry on the secondary level. The BA Ed is specifically designed to produce high school chemistry teachers who would remain in the region to serve.

The chemistry faculty members are also dedicated to excellence in teaching and demand academic excellence from our students. We also pride ourselves in having programs which are student-centered with research activities that allow students to grow. One of our main focuses is to serve the community, region, and state through partnerships.

- *Describe methods to be pursued for program improvement.*

Although we feel this area is very strong, we will continue to refine the structure of the program to coincide better with the mission of the university.

IV. Conclusion About the Program's Viability at CSU

CSU is primarily a teaching institution; therefore the chemistry faculty members pay serious attention to the teaching of undergraduates. As directed by ACS, the National Science Education Standards (NSES), and NSF's Directorate for Education and Human Resources, the faculty members are guided by indicators of good teaching/learning: openness to students, respect for students, using student-centered and inquiry-based pedagogies, using computer technology to improve the learning environment, and involving students in cutting-edge research projects so that they get some sense of the "thrill "of the discovery. We are glad to report that our customers (the students) are extremely impressed with the life-long experiences that they receive from the department of chemistry. Formative evaluations have provided qualitative comments that attest to the superb job done by the chemistry faculty. For example, in Rachel's (students') own words (un-edited):

> "I am a clinical nutritionist going back to school for medical school prerequisites. My most memorable moment in science courses was in *Chemistry II* at CSU when I made the connection between giving KCl as an IV rider at the hospital to patients with low potassium levels and how the KCl dissociates to K^+ and Cl^-. I finally understood the chemistry behind the medical treatment – Aha!".
>
> *Rachel*

The department of chemistry is experiencing tremendous growth and success in teaching and research arenas (Table IV.1). The ethnically diverse chemistry faculty members are excellent role models and participate in outreach activities including science demonstrations, recruiting, retaining (Table IV.2), and advancing all students (majorities and minorities).

Table IV.1. Undergraduate enrollment by major program and by upper division program.

Year	Number of Students	Year	Number of Students
2003/04	39	2003/04	13
2004/05	51	2004/05	16
2005/06	64	2005/06	20

Table IV.2: Retention rates.

Major program	Number in Fall 2003 Cohort	Fall 2003 Cohort Returning Fall 2004		Number in Fall 2004 Cohort	Fall 2004 Cohort Returning Fall 2005	
		Number	Rate		Number	Rate
Chemistry	13	9	69.2%	11	9	81.8%

For the past 3 years, students have over-subscribed across all chemistry and non-chemistry courses (e.g., Survey of Chemistry I and II for the Nursing Program). The high demand for advanced chemistry courses is not only attributed to successes in local business sectors but also to the increase in the number of students interested in pursuing graduate school or health science degrees (e.g., pharmacy and medical). Moreover, as part of their professional development commitments, faculty members provide support services to a large number of students who are non-chemistry majors (e.g., Biology and Nursing programs). Student internships and faculty professional development programs are enhanced through collaborations with Research I Universities, research labs, and local industries.

V. Program Improvement Plan

- *Highlight the department's plans, priorities, and timetable for improving the program's quality and productivity if the program is judged to be viable.*

The five-year strategic planning for the department includes seeking accreditation by the ACS. As we move toward ACS approval, emphasis will be placed on: learning to learn, learning science, and learn to teach science. Ultimately, having an ACS approved program will "fertilize" undergraduate education and strengthen our outreach services (e.g., chemistry demonstrations) to the community; thus increasing the number of K-12 students choosing STEM careers. After the five year plan is complete we intend to launch a Master of Science (M.S.) degree program in chemistry. The M.S. program will be tailored to the needs of chemistry majors, high school chemistry teachers, and a bridge for the terminal degree in chemistry.

Based on cognitive and affective assessment data from students and faculty, the department of chemistry has identified the following specific areas that need improvement: 1) keep the teaching loads for the faculty between 12 to 15 contact hours per week) so that they can engage in additional professional development activities (e.g., research, seminars, and national meetings); 2) Hire one additional "freelance" faculty or research associate who will coordinate introductory lab classes and maintain the stock room; 3) use writing as an additional tool for effective teaching/learning; 4) increase the number of visiting speakers so that students get additional real-life experiences; 5) incorporate research into lab experiments so students experience the joys of science investigations; and 6) seek federal grants for improvement of library resources and acquisition of NMR.

VI. Summary Recommendation

Highlight the department's recommendations, rationale, plans, and timetable for expanding, maintaining, reducing, or consolidating/discontinuing the program.

Department's recommendations:

The mission of the chemistry program is to prepare students from diverse backgrounds (e.g., ethnic, social, economic) for graduate or professional schools and for careers as teachers or professional scientists. To improve the quality and productivity of the program, the faculty members have proposed a five-year strategic plan with the following specific goals: 1) seek American Chemical Society (ACS) accreditation, 2) create an autonomous chemistry department, 3) increase enrollment, actively engage in recruitment and 4) enhance the quality of the chemistry curriculum.

Rationale:

Chemistry is a central science and pervades all science disciplines. The seven ethnically diverse faculty members are staunchly committed to excellence in teaching, research, and community outreach activities. Their expertise in the five areas of chemistry (i.e., analytical, biochemistry, inorganic, organic, physical, and chemical education) makes them invaluable resources to several departments at CSU. Implementation of the five-year strategic plan will make the chemistry program grow in size, become more productive, and diversify its funding opportunities. In particular, ACS accreditation will not only advance the image of the program but also facilitate recruitment of high caliber undergraduate and high school students. One of the requirements for maintaining certification is the acquisition of modern research equipment, especially Nuclear Magnetic Resonance (NMR) spectrometer. The low number of chemistry graduates is worrisome. However, the faculty members have a solid plan for recruitment, retention, and the advancement of undergraduates. As an autonomous unit, the chemistry department will provide more focused quality services to students and faculty (e.g., professional development opportunities, mentoring programs, advising, tutoring, and career opportunities).

Plans:

a. Write grant proposals seeking funds to improve teaching, research, and library resources
b. Recruit (high schools/community colleges/etc.) students from diverse populations
c. Increase enrollment and graduation rates in chemistry majors
d. Hire an additional faculty member and a stockroom manager
e. Improve student services (e.g., mentoring programs, advising, tutoring, and career opportunities)
f. Professional development for faculty members (e.g., training in new instruction technologies)
g. Strengthen collaborations with various institutions (e.g., industries, middle/high schools, government labs, community colleges, Research I Universities, and international organizations)
h. Develop additional elective/upper level chemistry courses
i. Assess advising using *BOR's Academic Advising Questionnaire*
j. Incorporate research-based experiments into lab courses
k. Incorporate scientific writing across chemistry courses

Timetable for Expanding:

The following is a tentative five-year timetable for expanding the chemistry program:

Activity	Date
1. Acquire information from ACS regarding accreditation	Fall 2007
2. Seek ACS accreditation	Fall 2009
3. Create an autonomous chemistry department	Aug. 2007
4. Submit NMR proposal to NSF's CCLI program	May 2007
5. Hire an additional faculty member and a stockroom manager	2008
6. Develop additional elective/upper level chemistry courses	Jan. 2007-2011

7. Recruit students from diverse populations	Jan. 2007-2011
8. Increase enrollment and graduation rates in chemistry majors	Jan. 2007-2011
9. Incorporate research-based experiments into lab courses	Jan. 2007-2011
10. Incorporate scientific writing across chemistry courses	Jan. 2007-2011
11. Assess advising using *BOR's Academic Advising Questionnaire*	April 2007-2011
12. Professional development for faculty members	Jan. 2007-2011
13. Improve student services	Jan. 2007-2011
14. Strengthen collaborations with various institutions	Jan. 2007-2011

Maintaining the program:

The chemistry program will be maintained through the steps outlined in the "Describe methods to be pursued for program improvement" section of CPR report. Some general statements include:

a. Developing additional elective/upper level courses
b. Revising existing BA and BA. Ed programs
c. Increasing enrollment in upper level courses
d. Increasing retention and graduation rates
e. Enhancing library resources (e.g., SciFinder)
f. Increasing career opportunities for students (e.g., job fairs, seminars)
g. Enhancing the quality of teaching (e.g., using new technological advances in classrooms)
h. Enhancing student-faculty research
i. Enhancing faculty professional development programs
j. Continue using undergraduates as laboratory teaching assistants
k. Launching a graduate program in 2012