



University of
West Florida

PROGRAM REVIEW 2003 - 2004

Department of Chemistry
College of Arts and Sciences

40.0501 Chemistry, BS
40.0501 Chemistry/Biochemistry, BS

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DEPARTMENT OF CHEMISTRY

Program Review 2003-2004

40.0501 Chemistry, B.S.
40.0501 Chemistry/Biochemistry, B.S.

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THE UNIVERSITY OF WEST FLORIDA

Academic Program Review Executive Summary

Department/Division: Chemistry

Chair: Stephen P. Tanner

Review Dates: April 5, 6, 2004

Programs Reviewed:

CIP Code	Degree Level	Degree Name
<u>40.0501</u>	<u>BS</u>	<u>Chemistry</u>
<u>40.0501</u>	<u>BS</u>	<u>Chemistry/Biochemistry</u>
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Nature of the Review

Self-study with Program Review Team including an external consultant, a UWF faculty member outside the department but inside the college, and a UWF faculty member outside the college.

Brief Description of Program(s)

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Mission

The mission of the Chemistry Department is to offer outstanding student-centered programs and coursework for majors in chemistry and other disciplines by providing individualized instruction, hands-on laboratory experience, and research opportunities.

The faculty is committed to quality teaching, research, and professional service; to cooperation with other departments in undergraduate and graduate interdisciplinary programs; to collaboration with local industry; and to the support of science education in regional K-12 schools and community colleges.

Curriculum

The Department of Chemistry offers two B.S. degree tracks, Chemistry and Chemistry/Biochemistry and a minor. The department also participates in a BS/MS program in Biological Chemistry. In this program students follow the Chemistry/Biochemistry track for three years, and then enter the MS program in biology. During the next two years they complete the requirements for both BS and MS degree

and are awarded them concurrently. Students accepted into the Chemistry/Pre-dental program also follow the Chemistry/Biochemistry degree track for three years and then enter the dental program at the University of Florida. After completion of the first year in dental school they are awarded the BS in Chemistry/Biochemistry.

The chemistry department is also one of the participating departments in the Interdisciplinary Science Program. The Chemistry courses required for the program are the same as those required for a chemistry minor.

Student Learning Outcomes and Assessment (for each program)

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Educational Program

Majors

1. Students completing any of the chemistry tracks are expected to have a solid background in chemistry and related fields.
2. In their knowledge of the subject matter and their ability to communicate both orally and in writing, they should be comparable to students graduating from the nation's best colleges and universities.
3. U.W.F. chemistry graduates should be able to compete successfully for positions in the chemistry industry, graduate schools and in professional schools.
4. They should be qualified to be successful in their chosen areas.

Non Majors

1. Students completing the general chemistry program should have a sound background in chemistry and an understanding of chemical phenomenon. They should be prepared well enough to take further study in chemistry or related fields.
2. Students completing the first year of organic chemistry should have an understanding of the subject such that they are able to apply it to their own field of study.

Research Outcomes/Outputs and Assessments

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Research and creative activity are important aspects of the department's mission. Such research may be in experimental or theoretical chemistry, or may be applied research on industrial and environmental problems. Since undergraduate education is the principal focus of the department, research in chemistry education is an important part of the department's mission. When possible, research should involve undergraduate students.

The Education Program is assessed by the following criteria:

1. The quality of the overall program can be compared to standards defined by the committee on Professional Training of the American Chemical Society. Both chemistry and chemistry/biochemistry degrees are approved by the A.C.S. This approval is obtained only after extensive review of the program and course content.
2. The success of individual courses can be tested by the use of standardized examinations prepared by the Division of Chemical Education of the American Chemical Society.
3. The performance of U.W.F. graduates in graduate schools or professional schools can also be used as a measure of the program's success. Many graduate schools in chemistry give placement examinations to entering students. The result of these tests is a reflection of the quality of the student's undergraduate program.
4. The ability of U.W.F. graduates to complete graduate degrees and embark on successful careers is another measure of program quality.
5. The readiness with which graduates find employment and the willingness of the employers to hire more U.W.F. graduates are indicators of the success of the program in preparing students for industrial employment.
6. In order to evaluate the effectiveness of the chemistry program systematically, a questionnaire is mailed to graduates 6-12 months after graduation and again after 3 years. Any deficiencies noted in the surveys may result in a modification of the program. Suggestions improvement will also be taken in consideration as we continually evaluate our program.

Research

Scholarship and creative activity are assessed according to the following criteria:

1. Published research papers in national and international journals.
2. Chapters or books on specialized subjects.
3. Invited lectures to international, national, or regional meetings.

Significant

1. Published papers of a non-research type.
2. Presentation of research results at international, national or regional meetings.
3. Editing of journals or books.
4. Grants received.
5. Contracts received.
6. Evidence of research and creative activities which have resulted in formal publication.
7. Evidence of continuing professional development; demonstration of creativity as an officer in the American Chemical Society or allied professional organization; as a program chairman; etc.

Service Outcomes/Outputs and Assessments

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Service is assessed using the following criteria:

Community Service

1. Participation in the activities of the Pensacola Section of the American Chemical Society and provide leadership and support.
2. Providing advice on chemical matters when requested by the media or the public or small business.

Service to Schools and Colleges

1. Working closely with local high schools teachers, assisting whenever possible and helping to improve the quality of high school chemistry programs.
2. Working closely with community colleges to solve articulation problems.
3. Involvement in faculty development programs for community college and high school faculty.
4. Helping students with science fair projects.
5. Assisting local schools test book selection, examination preparation and curriculum development.

6. Assisting in organizing district wide activities such as mathematics or science contests, science fairs (as judges, etc.) And other science education activities.

Service to the University

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1. Participating in university and college governance by serving on councils in the university. The faculty should contribute to the smooth operation of the science facilities and help maintain equipment.

Enrollment Trends (5 years; for each program)

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Headcount (Fall)

Chemistry	Lower Division	Upper Division
2003-2004	18	16
2002-2003	29	10
2001-2000	21	13
2000-2001	13	14
1999-2000	13	19

Chemistry/Biochemistry	Lower Division	Upper Division
2003-2004	8	9
2002-2003	11	19
2001-2000	9	11
2000-2001	15	4
1999-2000	12	6

Degrees Awarded

Year	Number of Degrees
2002-2003	15
2001-2002	3
2000-2001	8
1999-2000	12
1998-1999	2

Curriculum

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Major Changes since Prior Review

Since the last review there have been no major changes in the chemistry degree programs. All the courses have been updated and improved and a few new courses, Molecular Modeling, Computational chemistry, Polymer Science, Materials and Engineering Chemistry, have been added and are offered on a rotation basis. Some major program changes and new degree offerings have been proposed, and are currently under review by curriculum committees.

Statutory Mandates

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Required Common Prerequisites (bachelor's only)

24 Semester Hours - Chemistry

32 Semester Hours – Chemistry/Biochemistry

Credits-to-degree Limits (bachelor's only) **120 Semester Hours**

Limited Access Status (bachelor's only) **N/A**

Articulation with Feeder Institutions

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The department works very closely with the four principal community college feeder institutions, Pensacola Junior College, Okaloosa Walton College, Gulf Coast Community College and Chipola Community College. The department articulates on a regular basis with all four colleges and invites students from these colleges to use our equipment. Within the framework of the Pensacola Section of the ACS, the chemistry department at UWF, PJC, and OWCC arrange a four county chemistry examination (Chemathon) for high school students and jointly award two scholarships to top performers.

The department arranges workshops for junior and senior year students in Pensacola High Schools International Baccalaureate.

Accreditation Status

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The B.S. program in both chemistry and biochemistry are accredited by the American Chemical Society.

Responses to Recommendations from Previous Reviews

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The previous review in 1991 made the following recommendations.

1. Students

This program, though excellent, is small (25 chemistry majors). We recommend that the Department implement initiatives to attract more students to this program.

The number of chemistry majors has not increased but the number of students enrolled in chemistry courses has increased significantly. The department is proposing to offer a BA degree which, which while requiring only one new course will add six new tracks to the program. Since the last review, limited funding has reduced department recruiting activities, however, once the BA program is approved we intend to visit community colleges throughout the state in an effort to increase the number of chemistry majors.

2. Faculty

The Department needs not only to maintain its present strength but also to add junior faculty periodically to ensure continuation of the tradition of this outstanding program. We recommend that the faculty size be increased by addition of at least one junior faculty member, and that all retirements be replaced in order to avoid adverse effects on what may be the best undergraduate program in the Southeast.

This remains a problem. After the 1991 review one additional faculty member was added, a joint position in analytical chemistry with the CEDB. This person was not awarded tenure and the department lost the position. Most of the retiring faculty have been replaced, physical chemists, Birdwhistell and Jones (by Royappa and ter Haar), organic/biochemists, Halpern and Chang (by Huggins and Sirvent) but analytical chemist, Chiu, has not been replaced. The review suggested that new faculty be added but this has not occurred.

3. Space

The principal needs are for renovated space for Experimental I which is scheduled to lose space to general chemistry, and a room (or rooms) in which juniors and seniors can have written desks. Renovated space will also be needed for the high-field NMR spectrometer for which a proposal has been submitted. We recommend addition of this space as needed.

The space needs of the teaching program were alleviated by the construction of Building 58A. There is still a shortage of research space. As the senior faculty, who currently are not doing laboratory research retire, the new faculty will need

research laboratories. Within the next year, 3 additional laboratories will be needed.

4. **Support Personnel**

One additional storeroom person is needed as is a person to oversee and maintain the sophisticated instrumentation purchased recently. We recommend that one stockroom person and one equipment maintenance person be added as soon as possible.

A laboratory technician position (joint with the Biology Department) has been assigned to Building 58A to service the General Biology, Botany, and General Chemistry laboratories, and to maintain the greenhouse. An equipment maintenance person has not been hired. A coordinator of General Chemistry Laboratories has been hired in a non-tenured instructor level position.

Sufficiency of Resources and Support Services (to achieve goals/objectives)

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The current resources and support services are adequate. Over the past five years the department has received funds for the purchase of new equipment and instrumentation. With a few exceptions, the instrumentation available for an undergraduate program is very good. The service personnel, Coordinator of Academic Programs, Laboratory/Storeroom Manager, and Laboratory Technician which are all shared by the Biology Department adequately serve the needs of the Chemistry Department. The one office manager with one student assistant is adequate.

The extensive use of adjuncts in the teaching of the lower division laboratories is identified by the Review Committee as a problem area. The adjuncts fulfill an invaluable role in the chemistry department and several bring real world experiences which add to the programs. However, an additional full-time laboratory instructor in general chemistry, and a coordinator of the organic chemistry laboratories would reduce the dependence on adjuncts and bring more continuity to the laboratory programs.

There are two overriding problems which impede advancement of departmental goals and these are identified by this year's Review Committee. One issue concerns the offering of biochemistry at a level which builds on prior chemistry background. Current discussions are taking place with biology department faculty to determine if a course can be developed which can satisfy the needs of students in both departments. Biochemistry is one of the five subdisciplines of chemistry and it is growing in importance. It is important that the chemistry program keeps abreast of changes in the discipline and meets the ACS requirements. The committee has suggested a possible name change for the department, to the Department of Chemistry and Chemical Biology. This suggestion is consistent with the current trend which emphasizes the importance of the biochemistry area. The new BA track

as well as the BS tracks are all affected by our ability to offer appropriate coursework in biochemistry.

The second critical issue is the absence of an analytical chemist. Since the illness and subsequent retirement of Dr. Grace Chiu, the department has lacked the expertise of an analytical chemist. Analytical Chemistry is another of the principal subdisciplines of chemistry. It is required for all the chemistry degree programs (BS and BA) and is a requirement for Environmental Studies – Natural Science majors. The deficiency is recognized by all the employers of chemistry graduates and by graduate schools, and by the recent Review Committee. Almost all graduates of the chemistry program, who do not go to graduate school, are hired as analytical chemists. The department is convinced that the analytical chemist component of our program needs revision and modernizing and that an analytical chemist is required to do this. Currently, the analytical chemistry adjunct from Pensacola Junior College has hardly enough time to teach the course as it has been taught in the past and could not be expected to develop new courses. The analytical chemist is also needed to teach in the expanding general chemistry program.

In three years time, two more chemistry faculty will be retiring and plans should be made for hiring replacement and providing the necessary research laboratory facilities.

Strengths/Opportunities/Barriers (that support or impede achievement of goals/objectives) [Return to Table of Contents](#)

Strengths:

1. ACS approved program, competitive on a national level.
2. High caliber of the Faculty
3. One-on-one student faculty interaction
4. Well equipped laboratories.
5. Opportunities for undergraduate research
6. High quality and relevant lower division courses.
7. Flexibility of faculty in modernizing and streamlining programs and instituting new programs which serve the needs of students with a variety of career goals.

Barriers:

1. Lack of faculty expertise in analytical chemistry (see previous section)
2. Lack of clear plan to replace retiring faculty (see above)
3. Uncertainty concerning the level of support for maintaining accreditation and program quality.

Recommendations from Current Review

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- 1. Biochemistry courses.** The Chemistry and Biology Departments have not been able to resolve their different approaches to teaching biochemistry. The Chemistry Department emphasizes the need for a course that builds on foundational courses in organic chemistry (Organic Chemistry I and II). The biologists want their students to take Biochemistry as early in their program as possible so they want a course with minimal pre-requisites. Furthermore, they wish to minimize the number of courses taken outside the Biology Department to allow students to fit more biology courses into their schedules. This department has, consequently, dropped Organic II as a prerequisite for Biochemistry I (BCH3033). Dr. Ted Fox told the Review Committee that the increasing molecular emphasis in the Biology Department requires a strong biochemistry background. Examination of exams associated with the current version of Biochemistry I indicates that the course does not require organic chemistry pre-requisites and, in fact, includes many of concepts included in introductory chemistry courses. Consequently, the present form of Biochemistry I (BCH3033) course would not be suitable for chemistry degree students. The current Biochemistry I course as offered by the Biology Department may not completely serve the needs of medical technology majors, who are part of the Biology Department, according to Dr. Krothapalli, Director of the Medical Technology Program. Additionally, medical technology students need Organic Chemistry II even if this course is not a pre-requisite for their biochemistry course.

Recommendation. If there is to be a single biochemistry sequence at UWF, the Review Committee recommends that it reside in the Chemistry Department for the following reasons:

- (a) The material in Biochemistry I duplicates the content of some parts of general chemistry and Organic Chemistry II and, consequently, cannot meet the needs of chemistry students.
- (b) The biochemistry component of the chemistry program must meet ACS-guidelines. The level of Biochemistry I would make it difficult for the Chemistry Department to meet the ACS requirements for their degree program. The increasing importance of biochemistry/chemical biology within the chemistry curriculum and the increasingly interdisciplinary nature of the discipline are reflected in the change in name of some chemistry departments to "department of chemistry and chemical biology."
- (c) The more rigorous level of the chemists' approach to biochemistry will better serve the interests of both chemistry and biology students. Although not all medical schools require two semesters of organic chemistry and biochemistry, the MCAT exam requires the knowledge routinely included in Organic II. UWF students applying for medical school admission will be more competitive with a stronger background in chemistry and biochemistry.
- (d) Although the Review Committee had a very limited view of the Biology program, the growing molecular focus of biology suggested that a biochemistry experience more strongly--rather than less strongly--grounded in chemistry is

desirable. The Review Committee suggests that faculty members in both departments directly responsible for the biochemistry experience work together to craft courses that meet the needs of both chemistry and biology students. The increasingly interdisciplinary nature of both chemistry and biology should encourage and facilitate such an approach.

- 2. Membership of Chemistry in the School of Science and Engineering (SSE): An opportunity or hindrance for Chemistry?** Chemistry faculty members are, in principle, enthusiastic about joining this organizational unit to increase the opportunities to broaden chemistry ties with other Departments. Uncertainty about aspects of such membership dampens the enthusiasm for this liaison. Establishment of the organizational unit has been linked to constructing a new building to expand the space available for departments encompassed by it. The exact physical location and the size of the building have not been established, to the best of the Review Committee's knowledge. A location distant from Buildings 58 and 58a would have potential detrimental effects on the chemistry program: Separation of the lower division teaching labs from the remainder of the Department would isolate and degrade this part of the program. Currently the Chemistry and Biology Departments have many physical facilities in common included a shared storeroom. A physical separation of these two departments may require the duplication of equipment and personnel as well as making the current collaborations more difficult. On the other hand, closer proximity to the Environmental Studies and Physics Departments would enhance collaborative research efforts as well as increase sharing of equipment and curriculum components.

Recommendation. The Review Committee recommends continued communication regarding the implications inherent in membership in SSE to ensure that such membership enhances the Chemistry Department program rather than harms it.

- 3. Non-replacement of retiring faculty members and faculty on special assignment.** The real strength of the chemistry program comes from a creative and hard-working faculty. The university practice of allowing a significant time period elapse before the replacement of retiring faculty members is particularly detrimental to the continuity and strength of this program. Although two faculty members retired in 2003 (Grace Chiu and C. W. Chang), only one replacement was hired: Dr. Tara Sirvent. A year elapsed between the retirement of Dr. W.P. Halpern in June of 2001 and the hiring of Dr. M. T. Huggins in the fall of 2002. Current Chair Stephen P. Tanner and Jerome E. Gurst are among the founding fathers of UWF; they both will retire within the next five years. The educational and professional backgrounds of the current six tenure-track faculty members and one full time lecturer, all with doctorate in chemistry, provide the needed expertise in four of five major sub-disciplines of chemistry:

Inorganic: Professors S. P. Tanner and L. W. ter Haar and Instructor P. S. Tanner

Physical: Professors ter Haar (1/3 time) and A. T. Royappa

Organic: Professors J. E. Gurst and M. T. Huggins

Biochemistry: Professor T. M. Sirvent

None of the current faculty member has expertise in analytical chemistry, the fifth major area of this discipline, and that of Dr. Grace Chiu who retired in 2003; authorization has yet to be given for her replacement. In the absence of this expertise in the department, Dr. S. P. Tanner has taught CHM3120/L Analytical Chemistry and an adjunct, analytical chemist Dr. Lois A. Dixon from Pensacola Junior College, has taught CHM4130/L Instrumental Analysis. The continued absence of an analytical chemist at UWF will lead to deficiencies in the analytical chemistry and in the general chemistry curriculum. A strong background in analytical chemistry for UWF graduates is particularly important because Solutia, a major employer in the area, emphasizes strengths in this sub area of chemistry as a hiring criterion. ACS guidelines require instruction in all five major areas for an approved program. Continued ACS approval, a measure of a strong and vigorous program, is essential for the health of the UWF Chemistry Department. The employers interviewed during the Review said that they would not hire UWF chemistry graduates if the program loses its ACS-approval.

Dr. ter Haar's current assignment (beginning in January 2004) in the Dean's Office limits his contributions to the program; only one-third of his time is spent in the Chemistry Department. The advanced courses for which he obtained major NSF-CCLI funding and developed for majors (CHM3775 Molecular Modeling and CHM4512) cannot be offered in his absence from the Department. The proposed curriculum changes categorize these courses as advanced electives to be taught when ter Haar is available.

Recommendations: (1) A tenure-track analytical chemist should be added to the faculty as soon as possible. (2) Plans and a time table for replacing the near future retirement of Professors Tanner and Gurst should be drafted. Considering these three positions simultaneously in terms of an overall plan for the future of the Department will allow it to maintain continuity in the program, ensure appropriate representation of the sub areas of chemistry, and maximize the opportunities for interdisciplinary ventures. Professor Tanner has provided strong leadership to the Department as Chair for many years. Planning for the future must include the need for a new Chair on his retirement.

- 4. Too heavy reliance on one individual for introductory chemistry labs and too heavy use of adjuncts with inadequate compensation.** The tenure-track faculty lecture in both lower and upper level courses; they also teach all laboratories in the upper level courses. Lecturer Dr. Pamela S. Tanner coordinates the work of the adjunct faculty members who teach the majority of the labs associated with the introductory courses as well as teaching some of these labs herself. In collaboration with lecturing faculty, she has revised the experiments, written lab manuals, and developed grading schemes for the introductory chemistry curriculum. The large number of adjuncts (5 during the current semester) and the large enrollments in these labs place an inordinate responsibility for the success of the program on this

one individual. Tanner's fall teaching of four laboratories provides 16 hours of student contact time, exceeding the 15-hour maximum dictated by ACS guidelines (2003 *Guidelines of the ACS Committee on Professional Training*, www.chemistry.org/cpt). Offering introductory courses both during the academic year and the summer also limits the time available for her professional development. In Instructor Tanner's absence, the introductory laboratories would not function smoothly, if at all. The addition of an additional full-time instructor to the Department roster would make the program more stable and provide opportunities for Tanner's continued professional development as well as time for further curricular revisions.

Overall, about 40% of students enrolled in chemistry courses in the spring of 2004 were taught by adjunct faculty.

(https://nautical.uwf.edu/accreditation/dsp_facultyRoster.cfm downloaded April 12, 2004). In addition to the adjunct currently responsible for the instrumental analysis course, adjuncts teach all the introductory labs except for those taught by Instructor Tanner and also play a major role in the organic chemistry labs (CHM2200L, CHM2210L, and CHM2211L) although tenure-track organic chemists teach some labs for these courses. The students interviewed during the review process--many of whom function as teaching assistants in the intro labs--voiced dissatisfaction with the limited availability of the adjuncts beyond the time scheduled for their assigned labs.

The Department has, nonetheless, found skilled and committed individuals whose professional backgrounds complements those of the regular faculty and who bring special skills to the chemistry program: a retired chemist from Solutia teaches many of the organic labs; a retired high school chemistry teacher--currently chair of the local ACS section--teaches introductory labs; and local psychiatrist teaches courses for nursing students. The Review Committee was impressed with the strong commitment of this group of individuals to the Department. While the use of adjuncts to deliver unique expertise to students is acceptable, continued use of this group to meet routine instructional needs (such as teaching introductory labs) is educationally unsound and, given the meager financial rewards, exploitative of individuals. While the adjunct issue may well be a campus-wide problem, reliance on adjuncts to deliver such a large portion of the Chemistry Department laboratory program does not provide for continuity and renewal of this program. Instructor Tanner's supervision of this group increases her workload and places unhealthy reliance for the program on a single individual.

Recommendation. Add at least one additional instructor position to the Department roster to reduce Instructor Tanner's workload, ensure continuity in the introductory program, and increase student access to their instructors. While it is undesirable to increase the number of non-tenure track faculty by adding instructors, such positions provide greater stability and continuity for a program than the adjuncts. The Department Self-Study and Chair have indicated a need for an instructor to coordinate the organic chemistry labs, a position analogous to Tanner's. The Review Committee did not examine the staffing in the organic labs in the same detail as the introductory labs. The addition of an organic chemistry lab instructor may also be

needed, but would not alone address the problems identified with introductory chemistry lab instruction.

- 5. Limited space for faculty/student research.** While the current facilities in building 58 include three research labs for the three most junior faculty members (Royappa, Huggins, and Sirvent) and their students, new or remodeled laboratories must be made available for other faculty members. Dr. ter Haar carries out his computational research in the Chemical Simulations Laboratory, also used for classroom instruction. Future hires to replace Dr. Grace Chiu and the anticipated retirements of Drs. S.P. Tanner and J. E. Gurst will require additional committed space for research. Neither of the latter two faculty members has dedicated laboratory space for research activities. The increased emphasis on research, including possibility of using 6 semester credit hours of undergraduate research for all degree options, highlights the need for such space. The high research commitment and accomplishments of the current junior faculty mandates the availability of additional laboratories for future faculty. All or portions of the currently unused radiochemistry laboratory and counting rooms may be available to be remodeled for research labs. Even with such remodeling, more space must be found to support the increased research focus of the Department faculty and students.

Recommendation: Develop a long-term plan for increasing space for chemistry faculty and student research consistent with the place of Chemistry in the college and its subdivisions, that of Biology in the Division of Life and Health Sciences, and consistent with the increasingly important model of interdisciplinary research.

Concluding Remarks. Overall, the Review Committee found a strong and vigorous program chemistry program at the University of West Florida. The dedicated and hard working chemistry faculty is providing a modern, up-to-date chemistry education for its majors and as well as for other UWF students in its lower division courses. Despite the small size of the Chemistry faculty, the quality of its program, particularly the hands-on nature of the advanced laboratory courses, allow its majors to be competitive on a national level for admission to graduate and professional schools or to enter the workforce as professional chemists. The increasing emphasis on research in the Department will further strengthen the program. The greatest impediments to continued excellence are ones related to university budgetary constraints and infrastructure.

Plans for Follow-up on Recommendations (From current review)

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1. Biochemistry Courses

Recommendation: The organic/biochemistry faculty in the chemistry department are working with the biochemist in the biology department to introduce a new course to replace the current Biochemistry II. The faculty involved are attempting to design a course which will satisfy the needs of both chemistry and biology students. The

course will be a joint offering of the two departments with faculty from both departments involved in the design and delivery of the course.

2. Membership of Chemistry in the School of Science and Engineering (SSE): An opportunity or hindrance for Chemistry?

Recommendation: Since the site visit by the review team, the chemistry department has voted not to join the SSE. We will continue to collaborate with the departments which comprise the SSE and with other departments who are not part of the grouping.

3. Non-replacement of retiring faculty members and faculty on special assignment.

Recommendation: The Dean has agreed that the hiring of an analytical chemist should be a top priority and we hope to complete this hiring as soon as possible. The department will propose plans for the replacement of other retiring faculty and will work closely with the Dean to insure that the quality of the program will be maintained.

4. Too heavy reliance on one individual for introductory chemistry labs and too heavy use of adjuncts with inadequate compensation.

Recommendation: This problem will be partially alleviated with the hiring of an analytical chemist. This faculty member will have responsibility in the general chemistry program as well as the offerings in analytical chemistry. If Dr. ter Haar returns to full-time teaching, his involvement in the general chemistry program will also reduce the dependence on adjuncts. Full time faculty assisting with the general chemistry and freshman laboratory courses will reduce the supervisory work-level of the laboratory coordinator, Dr. Pamela Tanner. Future department plans call for the hiring of a coordinator of organic chemistry laboratories. This would indirectly reduce some of the problems referred in the report. The two coordinators would work together to provide continuity in the teaching of the lower division laboratory courses and each would be available to assist the other in either freshman chemistry or the organic chemistry laboratory programs.

5. Limited space for faculty/student research.

Recommendation: The department agrees with the reviewers' recommendation that more space is needed for faculty research. There is no research laboratory available for the analytical chemist and the three faculty research laboratories assigned to chemistry are being fully utilized by faculty and undergraduate research students. The problem will become more acute when Dr's Gurst and Tanner are replaced by younger faculty who need facilities for laboratory research. The department will propose a plan for adding research laboratories on a time table consistent with the hiring of new faculty

THE UNIVERSITY OF WEST FLORIDA

**ACADEMIC PROGRAM REVIEW
2003-04**

Department of Chemistry

**Chemistry Program Review Team
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May 4, 2004

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Dear Carl:

Attached is the report on the External Review of the Chemistry Department. It was a pleasure for me to be involved in the review process of such a fine department and with the other two members of the Review Committee, Joe Peters and Johan Liebens. The three of us were impressed with the quality of the chemistry program and the dedication of the chemistry faculty to the education of their students. The enclosed report reflects, I hope, that positive view of the department as well as recommendations to increase and maintain its strength.

Please let me know if you need additional information from me. I enjoyed meeting you and other members of the UWF community.

Sincerely yours,

Margaret V. Merritt (signature)

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External Review: Department of Chemistry, University of West Florida, April 2004

Overview. The External Academic Review Committee for the Department of Chemistry met April 5-6, 2004 at the University of West Florida. The Review Committee consists of Dr. Johan Liebens, Associate Professor of Environmental Studies at UWF; Dr. Joseph Peters, Professor of Science and Technology in the College of Professional Studies at UWF; and Dr. Margaret V. Merritt, Professor Emerita of Chemistry, Wellesley College. Dr. Merritt, the External Consultant, serves as a member of the Committee of Professional Training (CPT) of the American Chemical Society (ACS). This committee administers the review process through which colleges and universities may offer ACS-certified bachelor degrees in chemistry. The Chemistry Department at UWF has offered an ACS-approved chemistry degree program since 1970; it more recently added the newly instituted ACS-approved track in chemistry/biochemistry. Committee members had previously received the Department's self study and other informative documents. On April 5th and 6th, the Committee conducted its on-campus review through conversations and meetings with a variety of stakeholders in the UWF Chemistry program:

- Chemistry Department Chair Dr. Stephen P. Tanner provided a tour of departmental facilities and overview of the program.
- Dr. Carl Backman, Associate Vice President of Academic Affairs, gave an overview of the review process and expectations for its outcome.
- Dr. Jane Halonen, Dean of the College of Arts and Sciences, outlined a series of questions and concerns that she asked the Committee to use in guiding their work and helping her to chart the future of the department.
- The Chemistry Faculty members and staff met as a group with the Review Committee and provided an overview of the curriculum and discussed the strengths and current needs of the department.
- Five Adjunct faculty members, who teach the laboratories in the first and second year courses (introductory and organic chemistry), described their role in the Department program and their views of the chemistry program.
- Eight junior and senior chemistry majors provided a very positive and enthusiastic endorsement of the UWF chemistry program and described its strengths from their perspective.
- Eight UWF alumni with B. S. degrees in chemistry described the features of the chemistry program that have facilitated their work in their present positions.
- Four local employers of UWF chemistry graduates provided insight into the close links the Department maintains with the local technical communities through its alumni, the participation of faculty in the local ACS section, and meetings with an Advisory Board.
- Representatives from several other UWF departments discussed the interactions with chemistry faculty members and the impact of the chemistry curriculum on their own programs. ~

The schedule of the review, along with names of participants in each of the group, may be found in the Appendix. In addition to these formal meetings involving the full Review

Committee, Dr. Merritt met informally with members of the Chemistry Department: with Dr. Tanner on the evening of April 3rd with Professor Jerome Gurst for dinner on April 4th; with Instructor Dr. Pamela Tanner and Assistant Professors Michael T. Huggins, and Tara Sirvent for dinner on April 5th; and with Chair Dr. Tanner and Associate Professor A. Timothy Royappa for lunch on April 6th. These informal meetings allowed for in-depth discussions of the chemistry program at UWF.

Following a Review Committee discussion on the morning of April 6th the review concluded with an exit interview with Dr. Backman, Dean Halonen, Dr. ter Haar, and Dr. Tanner.

This report summarizes the findings of the Review Committee on the current state of affairs within the Chemistry Department and its relationship to the University structure. The Committee found the Department program to be a strong and vigorous one with excellent plans for the future in the proposed curricular changes. The major limitations to the future success of the Department and its program are ones that may be imposed by its relationships to other university departments and university infrastructure.

Mission. The current mission of the department is two-fold: (1) To provide students with a strong foundation of chemistry fundamentals for science literacy and for further studies in science and (2) to provide chemistry majors strong degree programs in preparation for entry into graduate and professional schools and chemistry-based industries. The multiple lower division courses--all with high enrollments and serving different student constituencies--attest to the Department commitment to the first objective. Further evidence of the attention given to teaching these courses is shown by recent university awards to Dr. Huggins and Dr. Royappa for their exemplary teaching in lower division chemistry course.

Continued ACS-approval of the chemistry program at UWF guarantees achievement of the second goal. ACS guidelines for curriculum content assist the Department in refining a high quality program in coursework, hands-on laboratory instruction, and research opportunities. Proposed curricular changes for chemistry and chemistry/biochemistry B.S. degrees are consistent with ACS-guidelines and with national trends in chemical education. Furthermore the increased emphasis on student-faculty research will increase the quality and visibility of the UWF chemistry program. The greater emphasis 'on interdisciplinary research of the UWF chemistry faculty members ensures that their work will stay at the forefront of science and have broad student appeal. The proposed new B.A. degree in chemistry, with multiple tracks, expands the mission of Department to serve students needing a strong background in chemistry but not planning careers as professional chemists. The Review Committee concurs with the Chemistry Department that these new B. A. degree options and changes in the B.S. curriculum will lead to modest increases in the number of chemistry major so that enrollments in upper division courses will increase.

Curriculum

Lower level courses/service teaching. Chemical principles provide the foundation for many sciences so that chemistry programs at all institutions, including UWF, must provide a variety of courses at the lower division. Introductory and organic chemistry courses serve these other science programs and chemistry majors as well as general education needs. The Review Committee judged that the number and level of the lower level courses offered by the UWF Chemistry Department is appropriate for UWF needs. The Committee was, in fact, impressed by the care and thought given by the Department in tailoring these courses to fit the requirements of other university programs. The student full time equivalent (FTE) for lower level courses in the fall of 2003 was 103.9 (http://uwf.edu/ir/factbk/fte_col_dept_lev03.htm downloaded March 31, 2004) and has increased from 75 FTE in 1999-2000.

Introductory Courses. The chemistry curriculum currently teaches three separate introductory courses/sequences: (1) Concepts in Chemistry/L (CHM 1020/L), a one semester General Studies Course, (2) Fundamentals of General Chemistry (CHM 1032/L) for students needing some chemistry for majors such as those in the Policy and Geography tracks in Environmental Studies, and (3) General Chemistry I and II (CHM2045/L and CHM2046/L) for students majoring chemistry, physics, biology, medical technology, and the science track in Environmental Studies. The Department is in the process of deleting a fourth course, CHM1025 Basic Chemistry, from its curriculum.

Organic Chemistry. Fundamentals of Organic and Biochemistry (CHM2200/L) is a one-semester course specifically 'designed to meet the needs of students in the Nursing program but can also be taken by students in the Policy track in Environmental Studies. Organic Chemistry I and II (CHM2210L and CHM2211/L) serve majors in chemistry as well as those in several other science programs. The recent decision of the Biology Department to eliminate CHM2211/L as a requirement for the biology major has serious consequences for the chemistry program, as discussed elsewhere in this report.

Degree programs and upper division courses.

Bachelor of Science. The Department currently offers two B.S. degree tracks: Chemistry and Chemistry/Biochemistry, both approved by the American Chemical Society. It also offers a minor. Pre-dental students, accepted into the Chemistry/Pre-dental program follow the Chemistry/Biochemistry track for three years and are awarded the B.S. degree following completion of one year of dental school at the University of Florida.

MS. degree. Students in the five-year BS/MS program *in* Biological Chemistry *follow* the Chemistry/Biochemistry track for three years and then enter the MS program in biology for two years with BS/MS degrees being awarded simultaneously.

Upper Level Courses. The upper level courses are currently taken almost exclusively by students in the B.S. Chemistry and Chemistry/Biochemistry tracks who plan on careers in chemistry (with immediate entry into chemical industry or graduate school in chemistry-related fields) or in medicine. The required upper level courses are similar to those

offered by all other institutions with ACS-approved chemistry programs. The one exception is a required third semester course of organic chemistry Organic Chemistry III:

Structure (CHM3230). A principle goal of this class is to ensure that all majors, *including transfer students from community colleges, understand the principles*, applications, and operation of the chemical instrumentation present in the Department. Such proficiency is necessary for the hands-on, laboratory-intensive focus of subsequent course required for the major. The Review Committee views this course necessary to meet the needs of the UWF student populations and applauds the Department for tailoring their curriculum for its own students.

The Department has proposed and submitted for university approval changes in both degree programs; copies of these proposed programs are attached. The Department members have worked cooperatively on these revisions for over a year. The Review Committee concurs with the Department that these changes along with the proposed new B.A. degree options will both streamline its course offerings and strengthen the program. The proposed changes primarily effect upper level courses and will continue to serve the Department mission in providing a strong chemistry background for students planning careers in chemistry, biochemistry, and in the health professions.

Of particular note are the new offerings In biochemistry/chemical biology in which a new 3-hour lecture course and associated 1-hour lab are required for both degree tracks. These *changes in the UWF chemistry curriculum are consistent with the recent ACS-*requirement for inclusion of a biochemistry experience in all degree programs. The new courses will substitute for the current degree requirements of Biochemistry/Lab (BCH3033/L) and BiochemistryII/Lab (BCH3034/L), taught in the Biology Department. The current version of Biochemistry I (with a recent change in pre-requisite to a single semester of organic chemistry) duplicates much of the material contained in Organic Chemistry II so that this biochemistry course is no longer suitable for students in chemistry degree tracks. The admission requirements for most medical schools include two semesters of organic chemistry and, in some cases, biochemistry (e.g., Florida State Medical School, <http://med.fsu.edu/StudentAffairs/admissionsCriteria.asp>). In contrast, the University of Florida requires only one semester of organic chemistry and one of biochemistry (<http://www.med.ufl.edu/oea/admiss/site/Regular.shtml>). Consequently, the Review Committee concurs with the decision of the Chemistry Department to offer a biochemistry curriculum with two semesters of organic chemistry as a pre-requisite. Such a course seems to serve the best interests of UWF students, including those pursuing a career in medicine.

Dr. Tara Sirvent (hired in September 2003 to replace Dr. C. W. Chang who retired in June 2003) has developed the new courses In biochemistry/chemical biology to provide biochemistry experience at the appropriate level, Principles of Chemical Biology (CHM499O) is currently being taught for the first time and a proposed lab (CHM499OL) is being developed. These courses build on the foundation of one year of organic chemistry, analytical chemistry, and one semester of physical chemistry and will satisfy the ACS-approved degree requirements as well as medical school admission criteria.

Enrollment in upper division courses. The small number of chemistry degrees (a total of 38 during five successive academic years ending in 2002-2003) leads to a low FTE for the Department in upper level courses relative to that for the lower levels: 12.3 in the Fall of 2003 (http://uwf.edu/ir/factbk/fte_col_dept_lev03.htm). The proposed addition of a series of B.A. tracks (forensics, environmental, pre-medical, pre-law, business, and education) will, the Review Committee believes, broaden the appeal of the program and, ultimately, lead to a modest increase in the number of majors. With one exception--a new one-semester course in physical chemistry, Basic Physical Chemistry (CHM3400C)--all tracks will require subsets of the *courses in* the B.S. program. The new physical chemistry course will also satisfy one of the requirements for the chemistry minor. Consequently, limited additional resources will be needed for the increased degree options. The environmental and education B.A. tracks will build on already strong relationships with other UWF programs. The latter track directly addresses the critical need for secondary school chemistry teachers in the state and is likely to meet the requirements for the ACS-approved degree option in chemical education.

This proposal to offer a B. A. degree in chemistry is consistent with national practices in chemistry education. Figure 1 (at end of report, p. 13) shows data compiled by the ACS-CPT on the total number of chemistry degrees (B.S. and B.A.) from ACS-approved programs as well as the percentage of certified degrees, corresponding to B.S. degrees, for the past three decades. The decreasing percentage of certified degrees from a high of 48% in 1973 to 37% in 2002 indicates an increase in B.A. degrees. The small national decrease in the total number of chemistry majors in the last few years, however, suggests that more degree options will not necessarily increase the number of chemistry majors.

The data of Figure 2 (end of report, p. 13) indicate that UWF productivity, as measured by the number of chemistry degrees/chemistry faculty member, is high compared to other ACS-approved programs in the Florida university system. Only Florida International had a larger productivity by this measure than the University of West Florida for the 2002-03 academic year. Comparisons with other chemistry departments nationwide may offer an assessment tool for evaluating the appropriate number of majors for the UWF program. The data for such comparisons of chemistry enrollments in different institutions are limited. CPT will be conducting a survey of chemistry course enrollments in the fall of 2004 for such comparative purposes.

The diversity in racial background of UWF chemistry majors has changed over the past ten years with 25-30% now being non-white relative to less than 10% in 1990. Women have constituted 50-60% of the majors in the past five years. The math prerequisite needed to enter General Chemistry I (MAC1105) places a barrier for entry into this degree program. Torn Westcott, Director of Advising, pointed out that this requirement, coupled with the state-imposed limitations on the number of credit hours for obtaining a degree, virtually eliminates poorly prepared students from all chemistry degree programs.

Recruitment and retention practices. The recruitment and outreach activities of the Department include workshops, seminars and other events for area middle and high schools; close working relationships with area community colleges on articulation issues and making Department equipment available to their students; participating in science fair projects; and participation in events for incoming and potential students.

The Department provides extensive tutoring services for beginning students in a dedicated tutoring room, staffed by chemistry majors who also serve as teaching assistants in introductory labs. Retention activities focus on involvement with learning chemistry outside the classroom through opportunities to attend seminars and meetings of the local ACS section and to participate in outreach activities. The Department sponsors an active ACS student affiliates chapter. Chemistry majors are clearly strongly involved and attached to the Department. Dr. Pamela Tanner coordinates retention activities for the department.

Student learning outcomes and assessment. (1) The Chemistry Department currently administers ACS standardized tests to evaluate the success of specific courses. The high scores indicate that students are well prepared in those areas for which these tests are available. (2) The acceptance of UWF chemistry graduates into top graduate and professional schools and their completion of advanced degree together with the ability of others to find employment also attest to the quality of the program. The Review Committee recommends more complete tracking of individual students to provide a more thorough evaluation of the program. (3) Feedback from UWF graduates on the effectiveness of the program is also obtained from written questionnaires sent to them 6-12 months after graduation and again after three years. A quantitative tabulation of these responses would provide a more complete picture of the alumni view of the department. The meeting between the Review Committee and alumni indicated high satisfaction for the chemistry program.

Community Service. Chemistry faculty and adjuncts provide the core leadership for the Pensacola Section of the ACS as well as working closely with local high schools and community college.

Research. The three most junior members of the faculty are currently most research-active in pursuing and obtaining outside funding and collaborations with other UWF in interdisciplinary programs. Drs. Royappa, Huggins, and Sirvent are members of the Working Group in Biological Chemistry, recently awarded a 6-year Merck/AAAS Undergraduate Research Program Grant to support collaborative undergraduate research projects with three members of the Biology Department at the interface of chemistry and biology. Royappa also has research collaborations with a member of the Mathematics faculty. Currently most majors participate in research under the direct supervision of a faculty member. During the five-year period ending in June of 2003, 39 students and 5 faculty participated in research. The proposed curriculum changes increase emphasis on research and should result in increased research activity in the department.

Facilities/Resources. Although the physical division of the Department into two buildings is not optimal, the close proximity of Buildings 58 and 58A allows good communication between students and faculty in the two locations. Building 58 houses faculty offices, the organic chemistry and upper division teaching laboratories, instrumentation rooms, research laboratories, a study room for majors, and a computer room. The main storeroom, shared with the Biology Department, and a solvent storage area are in this building. Building 58A contains the introductory chemistry instructional labs as well as a prep room, an instrument room, a computer lab, and a tutoring room. The faculty has been successful in obtaining NSF-CCLI grants that, along with state funds, provide excellent up-to-date instrumentation.

Staff. One full-time secretary, a stockroom manager, a Coordinator of Academic Programs, who serves as building manager and technician for maintaining instruments, and a laboratory technician who services the general chemistry and general biology, and botany laboratories (position currently unfilled) constitute the staff support for the department. The three laboratory support positions are shared with the Biology department. With filling of the technician position, the Committee judges the staffing to be adequate for the current program.

Interactions with other programs. The Department supports many other programs through its lower level courses and consults frequently with members of other departments to ensure that these courses meet the needs of these programs. The housing of the Chemistry and Biology Departments in Building 58 has allowed the programs to share facilities: specifically a storeroom including the personnel, controlled environment growth chambers, and some instrumentation. The physical proximity of the two departments has fostered interdisciplinary research collaborations.

Summary of Department Strengths

- The Chemistry Department offers a rigorous program, with continued approval by the American Chemical Society, and is competitive on national level. Although it appears to draw students from the local region, the quality of its program could serve a much larger potential student population. The regional focus of the Chemistry program is consistent with that of the university as a whole. The high caliber of the faculty and their availability for one-on-one interactions with students was reflected in praise from all current students and alumni. The open-ended nature of the advanced labs in which students have unlimited access to the exceptionally well-equipped laboratories is a unique feature of the program, resulting in excellent preparation of graduates for graduate school and professional employment as chemists. Opportunities for research under faculty supervision appear to be available for all majors. The quality of the lower division course reflects the Department commitment to providing a strong foundation in chemistry to all UWF students; the high enrollments in these courses indicate the appeal to these students.

- The Department is forward-looking in streamlining and refining the curriculum for the B.S. chemistry and chemistry/biochemistry tracks and in proposing B.A. degree tracks that will fulfill the needs of additional students interested in chemistry.
- The three most junior faculty members are active in research as attested to the number of students involved in their research, their publications and grant applications, and their establishment of interdisciplinary research projects.
- The Department recognizes the university goal of increasing the enrollments in the upper level courses and is actively pursuing routes to increase the number of majors by outreach to surrounding community and revising the curriculum. Their current efforts focus on regional appeal. It is not clear what additional efforts the department on its own can undertake to publicize its program and recruit additional majors. In many institutions, a significant fraction of chemistry majors come from those planning health-related careers. The placement of the Pre-professional studies major within the Biology Department makes it more difficult for students to be aware of opportunities afforded by a chemistry degree in pursuing their health-related career choices.

Issues of Concern and Recommendations for the Future

1. Biochemistry courses. The Chemistry and Biology Departments have not been able to resolve their different approaches to teaching biochemistry. The Chemistry Department emphasizes the need for a course that builds on foundational courses in organic chemistry (Organic Chemistry I and II). The biologists want their students to take biochemistry as early in their program as possible so they want a course with minimal pre-requisites. Furthermore, they wish to minimize the number of courses taken outside the Biology Department to allow students to fit more biology courses into their schedules. This department has, consequently, dropped Organic II as a prerequisite for Biochemistry I (BCH3033). Dr. Ted Fox told the Review Committee that the increasing molecular emphasis in the Biology Department requires a strong biochemistry background. Examination of exams associated with the current version of Biochemistry I indicates that the course does not require organic chemistry pre-requisites and, in fact, includes many of concepts included in introductory chemistry courses. Consequently, the present form of Biochemistry I (BCH3033) course would not be suitable for chemistry degree students. The current Biochemistry I course as offered by the Biology Department may not completely serve the needs of medical technology majors, who are part of the Biology Department, according to Dr. Krothapalli, Director of the Medical Technology Program. Additionally, medical technology students need Organic Chemistry II even if this course is not a pre-requisite for their biochemistry course.

Recommendation. If there is to be a single biochemistry sequence at UWF, the Review Committee recommends that it reside in the Chemistry Department for the following reasons:

- (a) The material in Biochemistry I duplicates the content of some parts of general chemistry and Organic Chemistry II and, consequently, cannot meet the needs of chemistry students.
- (b) The biochemistry component of the chemistry program must meet AC S-guidelines. The level of Biochemistry I would make it difficult for the Chemistry Department to meet the ACS requirements for their degree program. The increasing importance of biochemistry/chemical biology within the chemistry curriculum and the increasingly interdisciplinary nature of the discipline are reflected in the change in name of some chemistry departments to "department of chemistry and chemical biology."
- (c) The more rigorous level of the chemists' approach to biochemistry will better serve the interests of both chemistry and biology students. Although not all medical schools require two semesters of organic chemistry and biochemistry, the MCAT exam requires the knowledge routinely included in Organic II. UWF students applying for medical school admission will be more competitive with a stronger background in chemistry and biochemistry.
- (d) Although the Review Committee had a very limited view of the Biology program, the growing molecular focus of biology suggested that a biochemistry experience more strongly--rather than less strongly--grounded in chemistry is desirable.

The Review Committee suggests that faculty members in both departments directly responsible for the biochemistry experience work together to craft courses that meet the needs of both chemistry and biology students. The increasingly interdisciplinary nature of both chemistry and biology should encourage and facilitate such an approach.

2. Membership of Chemistry in the School of Science and Engineering (SSE): An opportunity or hindrance for Chemistry? Chemistry faculty members are, in principle, enthusiastic about joining this organizational unit to increase the opportunities to broaden chemistry ties with other Departments. Uncertainty about aspects of such membership dampens the enthusiasm for this liaison. Establishment of the organizational unit has been linked to constructing a new building to expand the space available for departments encompassed by it. The exact physical location and the size of the building have not been established, to the best of the Review Committee's knowledge. A location distant from Buildings 58 and 58a would have potential detrimental effects on the chemistry program: Separation of the lower division teaching labs from the remainder of the Department would isolate and degrade this part of the program. Currently the Chemistry and Biology Departments have many physical facilities in common included a shared storeroom. A physical separation of these two departments may require the duplication of equipment and personnel as well as making the current collaborations more difficult. On the other hand, closer proximity to the Environmental Studies and Physics Departments would enhance collaborative research efforts as well as increase sharing of *equipment* and curriculum components.

Recommendation. The Review Committee recommends continued communication regarding the implications inherent in membership in SSE to ensure that such membership enhances the Chemistry Department program rather than harms it.

3. Non-replacement of retiring faculty members and faculty on special assignment. The real strength of the chemistry program comes from a creative and hard-working faculty. The university practice of allowing a significant time period elapse before the replacement of retiring faculty members is particularly detrimental to the continuity and strength of this program. Although two faculty members retired in 2003 (Grace Chiu and C. W. Chang), only one replacement was hired: Dr. Tara Sirvent. A year elapsed between the retirement of Dr. W.P. Halpern in June of 2001 and the hiring of Dr. M. T. Huggins in the fall of 2002, Current Chair Stephen P. Tanner and Jerome E. Gurst are among the founding fathers of UWF; they both will retire within the next five years.

The educational and professional backgrounds of the current six tenure-track faculty members and one full time lecturer, all with doctorate in chemistry, provide the needed expertise in four of five major sub-disciplines of chemistry:

Inorganic: Professors S. P. Tanner and L. W. ter Haar and Instructor P. S. Tanner
Physical: Professors ter Haar (1/3 time) and A. T. Royappa
Organic: Professors J. E. Gurst and M. T. Huggins
Biochemistry: Professor T. M. Sirvent

None of the current faculty member has expertise in analytical chemistry, the fifth major area of this discipline, and that of Dr. Grace Chiu who retired in 2003; authorization has yet to be given for her replacement. In the absence of this expertise in the department, Dr. S. P. Tanner has taught CHM3120/L Analytical Chemistry and an adjunct, analytical chemist Dr. Lois A. Dixon from Pensacola Junior College, has taught CHM4130/L Instrumental Analysis. The continued absence of an analytical chemist at UWF will lead to deficiencies in the analytical chemistry and in the general chemistry curriculum. A strong background in analytical chemistry for UWF graduates is particularly important because Solutia, a major employer in the area, emphasizes strengths in this sub area of chemistry as a hiring criterion. ACS guidelines require instruction in all five major areas for an approved program. Continued ACS approval, a measure of a strong and vigorous program, is essential for the health of the UWF Chemistry Department. The employers interviewed during the Review said that they would not hire UWF chemistry graduates if the program loses its ACS-approval.

Dr. ter Haar's current assignment (beginning in January 2004) in the Dean's Office limits his contributions to the program; only one-third of his time is spent in the Chemistry Department. The advanced courses for which he obtained major NSF-CCLI funding and developed for majors (CHM3775 Molecular Modeling and CHM4512) cannot be offered in his absence from the Department. The proposed curriculum changes categorize these courses as advanced electives to be taught when ter Haar is available.

Recommendations: (1) A tenure-track analytical chemist should be added to the faculty as soon as possible. (2) Plans and a time table for replacing the near future retirement of Professors Tanner and Gurst should be drafted. Considering these three

positions simultaneously in terms of an overall plan for the future of the Department will allow it to maintain continuity in the program, ensure appropriate representation of the sub areas of chemistry, and maximize the opportunities for interdisciplinary ventures. Professor Tanner has provided strong leadership to the Department as Chair for many years. Planning for the future must include the need for a new Chair on his retirement.

4. Too heavy reliance on one individual for introductory chemistry labs and too heavy use of adjuncts with inadequate compensation. The tenure-track faculty lecture in both lower and upper level courses; they also teach all laboratories in the upper level courses. Lecturer Dr. Pamela S. Tanner coordinates the work of the adjunct faculty members who teach the majority of the labs associated with the introductory courses as

well as teaching some of these labs herself. In collaboration with lecturing faculty, she has revised the experiments, written lab manuals, and developed grading schemes for the introductory chemistry curriculum. The large number of adjuncts (5 during the current semester) and the large enrollments in these labs place an inordinate responsibility for the success of the program on this one individual. Tanner's fall teaching of four laboratories provides 16 hours of student contact time, exceeding the 15-hour maximum dictated by ACS guidelines (2003 *Guidelines of the ACS Committee on Professional Training*, www.chemistry.org/cpt). Offering introductory courses both during the academic year and the summer also limits the time available for her professional development. In Instructor Tanner's absence, the introductory laboratories would not function smoothly, if at all. The addition of an additional full-time instructor to the Department roster would make the program more stable and provide opportunities for Tanner's continued professional development as well as time for further curricular revisions.

Overall, about 40% of students enrolled in chemistry courses in the spring of 2004 were taught by adjunct faculty. (https://nautical.uwf.edu/accreditation/dsp_facultyRoster.cfm downloaded April 12, 2004). In addition to the adjunct currently responsible for the instrumental analysis course, adjuncts teach all the introductory labs except for those taught by Instructor Tanner and also play a major role in the organic chemistry labs (CHM2200L, CHM221OL, and CHM221 1L) although tenure-track organic chemists teach some labs for these courses. The students interviewed during the review process--many of whom function as teaching assistants in the intro labs--voiced dissatisfaction with the limited availability of the adjuncts beyond the time scheduled for their assigned labs.

The Department has, nonetheless, found skilled and committed individuals whose professional backgrounds complements those of the regular faculty and who bring special skills to the chemistry program: a retired chemist from Solutia teaches many of the organic labs; a retired high school chemistry teacher--currently chair of the local ACS section--teaches introductory labs; and local psychiatrist teaches courses for nursing students. The Review Committee was impressed with the strong commitment of this group of individuals to the Department. While the use of adjuncts to deliver unique expertise to students is acceptable, continued use of this group to meet routine

instructional needs (such as teaching introductory labs) is educationally unsound and, given the meager financial rewards, exploitative of individuals. While the adjunct issue may well be a campus-wide problem, reliance on adjuncts to deliver such a large portion of the Chemistry Department laboratory program does not provide for continuity and renewal of this program. Instructor Tanner's supervision of this group increases her workload and places unhealthy reliance for the program on a single individual.

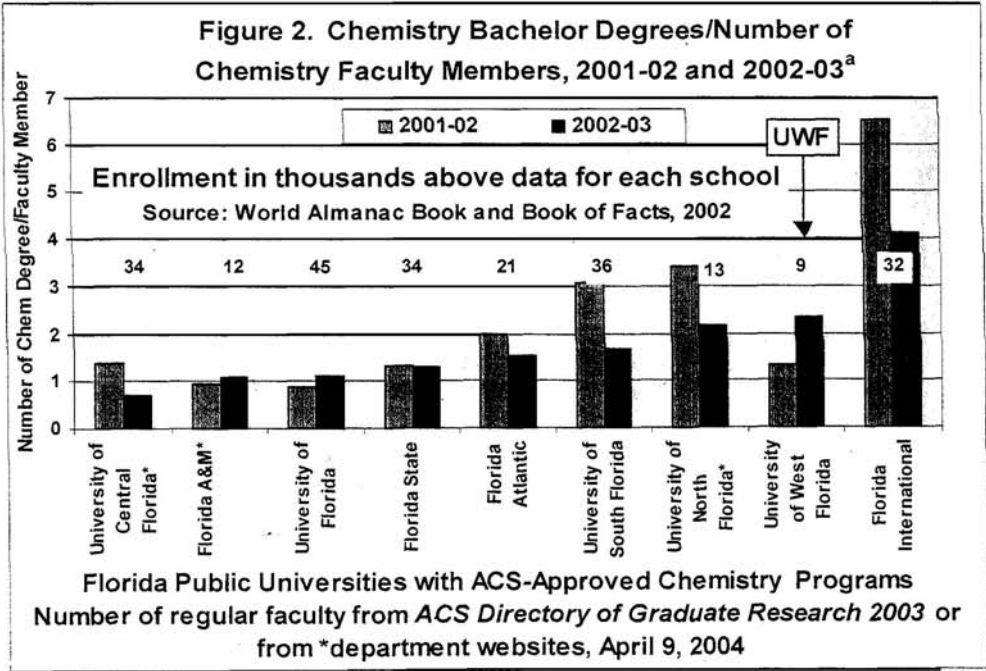
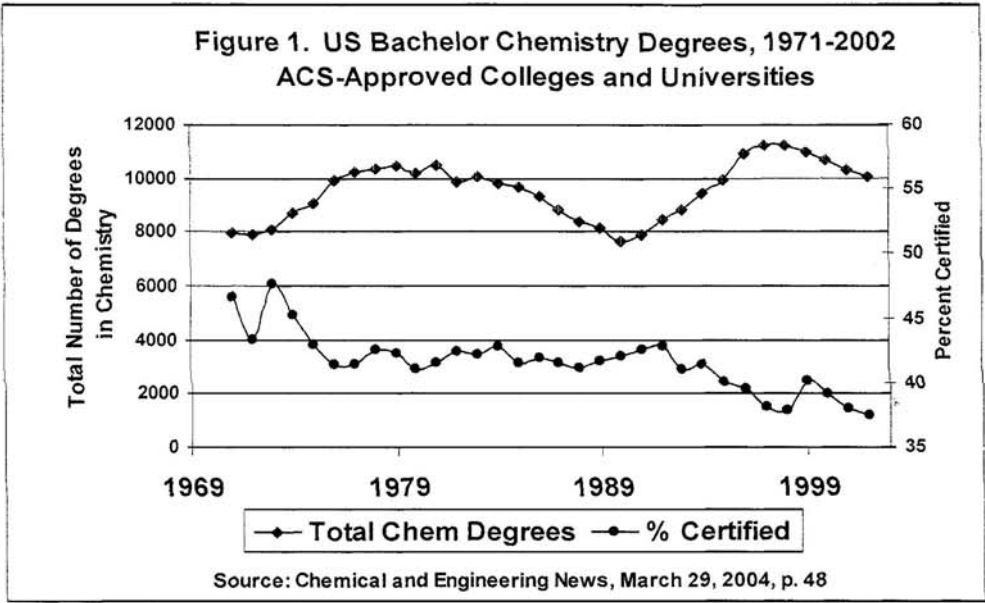
Recommendation. Add at least one additional instructor position to the Department roster to reduce Instructor Tanner's workload, ensure continuity in the introductory program, and increase student access to their instructors. While it is undesirable to increase the number of non-tenure track faculty by adding instructors, such positions provide greater stability and continuity for a program than the adjuncts. The Department Self-Study and Chair have indicated a need for an instructor to coordinate the organic chemistry labs, a position analogous to Tanner's. The Review Committee did not examine the staffing in the organic labs in the same detail as the introductory labs. The addition of an organic chemistry lab instructor may also be needed, but would not alone address the problems identified with introductory chemistry lab instruction.

5. Limited space for faculty/student research. While the current facilities in building 58 include three research labs for the three most junior faculty members (Royappa, Huggins, and Sirvent) and their students, new or remodeled laboratories must be made available for other faculty members. Dr. ter Haar carries out his computational research in the Chemical Simulations Laboratory, also used for classroom instruction. Future hires to replace Dr. Grace Chiu and the anticipated retirements of Drs. S. P. Tanner and J. E. Gurst will require additional committed space for research. Neither of the latter two faculty members has dedicated laboratory space for research activities. The increased emphasis on research, including possibility of using 6 semester credit hours of undergraduate research for all degree options, highlights the need for such space. The high research commitment and accomplishments of the current junior faculty mandates the availability of additional laboratories for future faculty. All or portions of the currently unused radiochemistry laboratory and counting rooms may be available to be remodeled for research labs. Even with such remodeling, more space must be found to support the increased research focus of the Department faculty and students.

Recommendation: Develop a long-term plan for increasing space for chemistry faculty and student research consistent with the place of Chemistry in the college and its subdivisions, that of Biology in the Division of Life and Health Sciences, and consistent with the increasingly important model of interdisciplinary research.

Concluding Remarks. Overall, the Review Committee found a strong and vigorous program chemistry program at the University of West Florida. The dedicated and hard working chemistry faculty is providing a modern, up-to-date chemistry education for its majors and as well as for other UWF students in its lower division courses. Despite the small size of the Chemistry faculty, the quality of its program, particularly the hands-on nature of the advanced laboratory courses, allow its majors to be competitive on a

national level for admission to graduate and professional schools or to enter the workforce as professional chemists. The increasing emphasis on research in the Department will further strengthen the program. The greatest impediments to continued excellence are ones related to university budgetary constraints and infrastructure.



Appendix

Groups meeting with Chemistry Review Committee

1. Alumni

Brian Roberts, 2003, Graduate Student in Chemistry, Florida State University
Joshua Lee, 2003, Graduate Student Chemistry, Florida State University
Anna Lomasney, 1998, High School Teacher
Michael Ishee, 1996, Research Scientist, Pall Corp
Patrick O'Neal, 1996, Lab Facilitator, Solutia
Bruce Lysek, 1992, Senior Research Chemist, Solutia
Brian Blanchard, 1993, Senior Research Chemists, Solutia
Ron Hambrick, 1984, Director of Environmental Health and Safety, *UWF*

2. Current Students (Junior and Senior Majors)

Dustin Dixon
Freida Billimoria
David Fehling
Alan Turner
Michelle Hester
Patrick Barber
Daniel Witter
Angelina Sansone

3. Employers

Dr. John Tria, Science Fellow, Solutia
Dr. Tony Uriarte, Manager of Intermediates Technical Group, Solutia and member of Advisory Board
Jan Macauly, Wetlands Research (UWF)
Dr Alan Ford, Environmental Chemist and member of Advisory Board

4. Representatives from other UWF Departments

Dr. Tom Westcott, Director of Advising
Dr. Chandra Prayaga, Chair, Physics Department
Dr. Ted Fox, Biology Faculty
Dr. Marilyn Lamborn, Program Director, Nursing Department
Ms. Swarna Krothapalli, Director of Medical Technology Program

5. Chemistry Adjunct Instructors

Larry Smith, Solutia — Retired
Glenda Marshman, Retired High School Chemistry Teacher and member of Advisory Board
Dr. Lisa Struck, Adjunct instructor at Pensacola Junior College
Dr. Martha Sarasua, Psychiatrist
Cheryll Mullin

**Program Review — Schedule
Department of Chemistry**

Monday, April 5, 2004	
8:00 am to 8:30 am	Team meets with Chair in 58 Conference Room
8:30 am to 9:00 am	Meet in President's Conference Room – Building 10
9:10 am to 9:40 am	Meet with Dean Halonen – Building 11
9:40 am to 10:20 am	Tour campus and department with Chair
10:20 am to 11:00 am	Break
11:00 am to 12:00 pm	Meet with Chemistry Faculty in 58 Conference Room
12:00 pm to 1:00 pm	Lunch — with Chemistry Faculty and Staff
1:00 pm to 2:00 pm	Meet with Adjuncts
2:00 pm to 3:00 pm	Meet with Students
3:00 pm to 4:00 pm	Meet with Alumni
4:00 pm to 5:00 pm	Meet with Employers

Tuesday, April 6, 2004	
9:00 am to 9:40 am	Meeting with representatives from other departments
9:45 am to 10:45 am	Team Conference
11:00 am to 12:00 pm	Exit Interview — Meet in President's Conference Room — Building 10

Proposed Chemistry Major	Program for CHEMISTRY majors entering as Freshman				
	CHM 2015 General Chemistry MAC 2311 Calculus I	4 credits 4 credits	CHM 2046/L General Chemistry II/lab MAC 2312 Calculus II	4 credits 4 credits	
	Total Chemistry Credit	4	Total Chemistry Credits	4	
	CHM 2210/L Organic I/Lab PHY 2048/L Physics I/Lab	4 credits 4 credits	CHM 2211/L Organic II/Lab PHY 2049/L Physics II/Lab	4 credits 4 credits	CHM 3120/L Analytical and Lab 4 credits
	Total Chemistry Credits	4	Total Chemistry Credits	4	Total Chemistry Credits 4
	CHM 3410 Physical Chemistry I CHM 3230 Organic III CHM 3740I Advanced Organic Lab	5 credits 3 credits 2 credits	CHM 3411 Physical Chemistry II CHM 3741L Physical Chemistry Lab Principles of Chemical Biology/Lab ¹	4 credits 2 credits 4 credits	
	Total Chemistry Credits	10	Total Chemistry Credits	10	
	CHM 3610 Inorganic Chemistry CHM 4130/L Instrumental Analysis/Lab Chemistry Elective*	4 credits 4 credits 3 credits	CHM 3742L Inorganic Synthesis Lab Chemistry Electives*	1 credit 3 credits	Total Prerequisites Credits 16 Total Chemistry Credits 55 Upper Division Chemistry 39
	Total Chemistry Credits	11	Total Chemistry Credits	4	
	* Students must complete two of the following courses: CHM 4512 Computational Chemistry ¹ CHM 4455/L Polymer Chemistry; Advanced Topics in Chemistry ³ ; CHM 4714C Materials, Chemistry, and Engineering; or Undergraduate Chemistry Research ⁴				
¹ The prerequisites for this class are CHM 2211/L , and CHM 3410 is strongly encourages. ² The prerequisites for this class are Chemical Biology and CHM 3410. ³ This class will vary in subject depending on the instructor, but should be organized to fulfill the ACS's advanced course requirement. ⁴ Undergraduate research is a 2-4 credit course, and a formal written report must be completed by the student in order to fulfill the ACS's advanced course requirement. A formal thesis must be written and presented to the department for those students who take this course twice for a total of 6 credits and use this course for both Chemistry electives.					

Proposed Chemistry/Biochemistry Major	Program for CHEMISTRY/BIOCHEMISTRY majors entering as Freshman			
	CHM 2045/L General Chemistry I/Lab	4 credits	CHM 2046/L General Chemistry II/Lab	4 credits
	MAC 2311 Calculus I	4 credits	MAC 2312 Calculus II	4 credits
	BOT 2010/L General Botany/Lab	4 credits	ZOO 1010/L General Zoology/Lab	4 credits
	Total Chemistry Credits	4	Total Chemistry Credits	4
	CHM 2210/L Organic I/Lab	4 credits	CHM 2211/L Organic II/Lab	4 credits
	PHY 2048/L Physics I/Lab	4 credits	PHY 2049/L Physics II/Lab	4 credits
	Total Chemistry Credits	4	Total Chemistry Credits	4
	CHM 3120/L Analytical and Lab	4 credits		
	Total Chemistry Credits	4	Total Chemistry Credits	4
CHM 3410 Physical Chemistry I ¹	5 credits	CHM 3411 Physical Chemistry II	4 credits	
CHM 3230 Organic III	3 credits	CHM 3741L Physical Chemistry Lab	2 credits	
CHM 3740L Advanced Organic Lab	2 credits	Principles of Chemistry Biology ²	3 credits	
		Princ. of Chemical Bio Lab	1 credit	
Total Chemistry Credits	10	Total Chemistry Credits	10	
CHM 3610 Inorganic Chemistry	4 credits	CHM 3742L Inorganic Synthesis Lab	1 credit	
Required Elective	3/4 credits	Required Elective *	3/4 credits	
Required Elective *	3/4 credits			
Total Chemistry Credits	11	Total Chemistry Credits	4	
		Total Prerequisites Credits	24	
		Total Chemistry Credits	55	
		Upper Division Chemistry	36/39	
		Upper Division Biology	4/8	
* Students must complete three of the following courses at least one of which must come from Group B: Group A: PCB 3063/L Genetics/Lab; MCB 3020/L Microbiology/Lab; or PCB 4524/L Molecular Biology/Lab; BCH 3034 Biochemistry II Group B: CHM 4512 Computational Chemistry; CHM 4455/L Polymer Chemistry; CHM 4130/L Instrumental Analysis; Advanced Topics in Chemistry ³ ; CHM 4714C Materials, Chemistry, and Engineering; or Undergraduate Chemistry Research ⁴				
¹ The prerequisites for this class are CHM 2211/L and CHM 3410 is strongly encouraged.				
² The prerequisites for this class are Principles of Chemical Biology CHM 3410				
³ This class will vary in subject depending on the instructor, but should be organized to fulfill the ACS's advanced course requirement.				
⁴ Undergraduate research is a 2-4 credit course, and a formal written report must be completed by the student in order to fulfill the ACS's advanced course requirement. A formal thesis must be written and presented to the department for those students who take this course twice for a total of 6 credits and use this course for both Chemistry electives.				

**Department of Chemistry
University of West Florida
Dean's Response to External Review
May 26, 2004**

At the outset of this response, I'd like to express my gratitude to the team members -- Margaret Merritt, Jorum Liebens, and Joe Peters -- for their exemplary report designed to assist us with charting the future course for the Department of Chemistry. The review wins quite thorough and especially helpful with understanding the national context in which the discipline of chemistry is evolving. In addition, the team was able to foster some frank conversation that helped us solve some problems even before they disbanded. That is a most welcome outcome of this activity.

Mission:

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The review team has pointed out that the department's mission is two-fold: providing students direction for future graduate studies and offering students a broad science background for employment after graduation. In the past the department's reputation has highlighted a tendency for the department to concentrate on the graduate school-bound, I applaud the steps that they have taken recently to implement tailored tracks within the major to promote specific kinds of career preparation. The plan is :all the more impressive because the objective is to develop the tracks from existing courses. If all goes well, it should produce much needed growth in enrollments in the upper level courses.

High Quality Faculty:

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The department has an admirable track record of helping its majors get ready for the next challenge. The feedback they have had on the quality of student preparation has been positive. They have developed a strong sense of unity, perhaps intensified by some of the faculty retirements that have happened lately. All of the faculty appear to be worried about the status of the department because I have been unable to replace the analytic chemist. I'll return to this problem at the end of the report. But it should be noted that they have a high quality, rigorous reputation and have carefully grounded their planning in the best practices of the ACS.

Curriculum:

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The department has designed several introductory courses to meet different kinds of audiences and currently delivers substantial FTE through this service. We are seeing a modest increase in enrollment at this level.

The department's reputation is very rigorous, which helps explain its reputation for solid preparation of students headed to graduate school. However, less able students appear to be opting to take chemistry at the local community college and transferring it in. It may be the case that this pattern is somewhat common for most chemistry

departments in four-year universities, but we need to reduce the drift of FTEs away from campus wherever we can, particularly for departments that wish to expand the scope of their activities. The expense of conducting the program makes it very challenging for me to secure all of the resources that have been identified for the program. It would help greatly if they will continue the new trajectory of trying to recruit and retain as many students in the major as they can

Organic II has been a point of contribution during the last year between Biology and Chemistry. The Biology Department decided to stop requiring Organic II, which has adverse effects on FTE for the Chemistry Department. This backdrop makes any loss of FTE something that will be hard on Chemistry; however, I'm working with Biology to try to facilitate better relationships between departments. I do not think the Biology Department will return the requirement of Organic II, but I think they are open to trying to help chemistry restore its FTE in other creative ways.

Diversity Concerns:

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I'm grateful that the committee was able to identify a specific hurdle regarding the recruitment of student of color in the major. I do not know if this means that we should explore permission to enlarge the major as a way of dealing with this constraint but hope the department would actively discuss this area of challenge. I was heartened that their guest speaker this fall dealt explicitly with this issue, a prominent concern for all of the sciences currently.

Recruitment and Retention:

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I agree that the department does a good job of outreach to the high school. I have been pleased by their response to SSE initiatives. I appreciated the participation of some of the members in the first science symposium. I am also especially appreciative of the approachability and enthusiasm of the new faculty to help build a stronger student base for the department.

Assessment:

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Chemistry's involvement with ACS dictates that some outcome measures need to be in place. I'm pleased to report that we are having conversations about ways to blend existing practice with emerging SACS and academic Learning Compact requirements. From my own study of the: ACS documents with regard to outcomes, I'm optimistic that the department could emerge as national leaders in this area.

Research:

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This is an area of dramatic contribution, driven by the collaborative effects of the younger members of the faculty. The collaboration opens up new opportunities for students to experience research with good mentors. In addition, the participation of department members in SSE activities and Project Kaleidoscope enhances the opportunity to develop innovative curriculum in line with some of the ideals set forth by the president.

Staff and Program Interaction:

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I am pleased about the shared staff members that you have with Biology. This is an efficient way to maximize resource use. The close proximity has facilitated some good collaboration and as these relationships strengthen, my hope is that we can get some of the past challenges behind us.

Pre-Professional Health Advising:

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It had not occurred to me that Chemistry might have an additional handicap in recruiting pre-med students because of Steve Celestial's responsibilities in biology. I'd like to encourage the department at minimum to develop some print material and talk with Steve about being able to provide input on this path. This seems like a reasonable expectation for a good neighbor.

ISSUES OF CONCERN/RECOMMENDATIONS

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Biochemistry:

All the time of the review, it was looking like we might be experiencing an irresolvable conflict around how biochemistry should be taught. Biochemistry courses had already been established in biology when the department decided with the hire of Tara Sirvent to begin to build the chemical biology aspect of the curriculum. She has been a superb hire; however, my office became involved due to concerns about duplication of offering. Happily, a special committee involving two people from each of the relevant departments appears to have developed an insight about possible format that will allow both populations to be served. The new plan calls for a shared biochemistry class at the junior level. For chemistry this experience will follow Organic II. I am optimistic that with some creativity we can figure out a way to share the burden legitimately and perhaps even elegantly between the two departments.

SSE:

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The on-site review was instrumental in getting some clarification about expectations of chemistry's involvement in the School of Science and Engineering. The department may have experienced undue pressure from me—not my intent—to sign on the SSE initiative. I'm glad that I had the opportunity to clarify why I asked chemistry to participate in those discussions and I'm grateful they understood the constraints imposed by the state on the planning of the new building. The reviewers questioned the wisdom of the prospect of a brand new building as the driver for the initiative. However, I believe that is too simplistic an interpretation of what is transpiring. There are multiple factors that support chemistry playing a role in the larger interdisciplinary push that we seem to be experiencing. I applaud their decisions to withdraw from the proposal for the new building, but may encourage a reopening of this conversation with the potential that the Solution proposal offers. I am pleased that they are willing to participate in related activities if not a part of the physical space.

Analytic Chemistry Replacement and Adjunct Issues:

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Our current serious shortfall of resources continues to prevent me from automatically replacing retirement positions. Chemistry is not the only department in this position in CAS. Obviously, I wish this were otherwise. but I inherited a seriously strapped budget and with faculty cooperation may be able to reduce the deficits to a tolerable level next year.

My hope is that this is a short-term problem and if ACS were to pull the accreditation because of that challenge, it would surprise me. Administrators all over the country are facing hard decisions about whether accrediting agencies of learned societies should dictate how resources are dispersed for an entire campus. If ACS responds in this fashion, it could in the long run harm the willingness of campuses to stay affiliated with ACS. I do plan to take this concern up with my colleagues at the next Council of Arts and Sciences Deans meeting.

If we are able to negotiate properly the opportunity we have brewing with Solutia, I believe that the president may be willing to see if we can get additional faculty line support to help enact this plan. If so, that will underscore the importance of planning the next generation of chemistry programming and secure the appropriate legacy for Chiu, Chang, Tanner, and Gurst. This opportunity may also address the concerns expressed about. about reliance on Pam Tanner and adjunct faculty to deliver beginning courses.

Facilities:

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I was a little surprised to learn that the department feels limited by the space they have. Although it may not be ideally configured, the space per person in the department may be among the most generous on campus. I think part of the need for space may stem from thinking about chemistry labs as spaces dedicated to single uses or interests of specific individuals in the faculty. If we do not achieve additional space, I recommend that we do a review of how the spaces are used to figure out if some of the needs can be met by smarter use.

On the other hand, I am eager to share the possibility that we might be able to develop an extraordinary solution to the space problems you describe through a partnership with a community partner. The President, Administrative Vice-President, and I have been engaged in a conversation with Solutia about the possibility of developing a "west" campus that might be dedicated to related "r&d" activities. With some imagination and willingness to think about an ambitious five year plan, we have some exceptional opportunity to try and exploit.

Conclusion:

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I look forward to working with chemistry on making progress on the problems highlighted by the team. I appreciate the department's commitment to quality. With the recognition provided by this review, timed so well with this great community opportunity, some wonderful things could lie ahead for this group.