UNIVERSITY OF SAN FRANCISCO

Department of Chemistry

Academic Program Review
Self-Study Document

December 2011

Academic Program Review: Self Study:USF Chemistry Department, Fall 2011

I. Introduction

A. Mission (approved Fall 2011)

The Mission of the Chemistry Program at USF is to deliver a broad-based, challenging chemical experience that will train students to participate effectively as professionals in a variety of careers including graduate programs, health professions, government or private industry and teaching. The program will foster a culture that: values strong student-faculty-staff interactions and strives to help students become self-learners, creates opportunities for students to discover the excitement and creativity of chemical research, and values an understanding of social responsibility with ethical behavior as part of a chemical community.

B. History

The Department of Chemistry has been offering an ACS accredited degree in chemistry for over 45 years and an ACS degree with a concentration in biochemistry for over 20 years. In addition, it offers minor programs in both chemistry and biochemistry. For the past 55 years, USF has maintained an active, laboratory/thesis based, Masters Degree program. The MS students are integrated into research projects and are supported by TA salaries in undergraduate lab sections with wavier of tuition. Introductory courses serve both our majors and biology, exercise and sports science and environmental science students, but no longer serves nursing students. USF does not have any engineering programs on campus. In the past 10-15 years, the department has delivered many different general education or "core" courses for the non science major that help students understand the nature of the physical world, the uses of the scientific method, and the implications of technology.

Since the last review, four faculty searches lead to hiring two new tenure track assistant professors (one was let go, one search failed), many new instruments were purchased via external grants and foundations, and there were significant staff changes as we are on our third administrative assistant, second stockroom manager (a new full time position) and second lab coordinator (new full time position). The chemistry majors and minors were streamlined to fit the 4-unit system at USF, resulting in fewer units in required courses to allow chemistry electives and undergraduate research (required for ACS certified majors). Finally, all prerequisite grades for our courses was raised to C from C- in 2010 after examination of the failure/withdrawal rates in Physical Chemistry courses, especially. The department is generally enthusiastic about these later changes and other changes to spread out the workload (especially lab sections) among all the faculty. We are already seeing new ideas, changes and improvements to general, analytical, organic and biochemistry labs as we all rotate through the curriculum. The details of these changes and goals for the department may be found in the body of this report.

C. The Faculty

The Chemistry Department has six tenured faculty (two at reduced teaching loads), one term faculty (special long-term appointment) and two tenure-track assistant professors. The alphabetical list below summarizes our specialties and current teaching roles. Please see the Faculty section later in this report for more details and the Appendix for brief biographies and CVs.

Professor -Speciality	Current Teaching Rotations	Past or Current Research Programs
Megan Bolitho Assistant Professor -Organic/Biochemistry	Organic Chemistry lecture/lab Biochemistry lecture/lab Chem 397: Undergraduate Research Chem 698: Graduate Research Elective: Medicinal Chemistry	Bacterial quorum sensing; inhibitors of LuxS quorum sensing enzyme
Claire Castro Professor -Organic/ Computational	Organic Chemistry lecture/lab Chem 397: Undergraduate Research Chem 698: Graduate Research	Computational tools to solve dynamic processes of annulenes, high temperature rearrangements of polycyclic aromatic hydrocarbons
John Cobley Professor -Biochemistry	Biochemistry II lecture Fundamentals Biochemistry Non-majors science courses	The genetics of photosynthetic acclimation of cyanobacteria to the spectral composition of ambient light
Jeff Curtis Professor -Physical Inorganic	General Chemistry lecture/lab Inorganic Chemistry lecture/lab Integrated lecture/Lab Chem 397: Undergraduate Research Chem 698: Graduate Research	Optical and thermal electron-transfer: redox kinetics, electrolyte effects, solvent-solute interactions, second coordination sphere interactions
Larry Margerum Professor -Inorganic/Analytical	General Chemistry lecture/lab Analytical lecture/Lab Inorganic Chemistry lecture/lab Chem 397: Undergraduate Research Chem 698: Graduate Research Elective: Solar Energy	Immobilized dendrimers, metal affinity tags and indicator displacement assays; Chemical Education Research
Willie Melaugh, -term faculty (full time)	Virtually all lower division courses, plus junior level biochemistry.	(not active) Application of mass spectrometry to biological problems
Giovanni Meloni, Assistant professor -Physical	General Chemistry lecture/lab Physical Chemistry Integrated lecture/Lab Chem 397: Undergraduate Research Chem 698: Graduate Research	High-temperature physical chemistry; spectroscopic characterization of reaction intermediates using the Advanced Light Source of LBL
Tami Spector Professor -Physical Organic	Organic Chemistry lecture/lab Non-majors science course	Molecular aesthetics; art-science interactions; promotion/organization of events/publications that focus on the intersections of art, science and aesthetics
Kim Summerhays Professor -Physical Chemistry	General Chemistry lecture/lab Analytical lecture/Lab Physical Chemistry	Economic implications of Type I and Type II errors; potential economic optimizations for process control

Faculty Achievements

Since 2005, the faculty has had two retirements and two new assistant professors are starting their research programs. The highlights from our activities since the last review are presented below under Outside Funding, Publications, and Service. Details may be found in the appendix of faculty CVs.

Outside Funding since 2005

- Three NSF Grants, two ACS-PRF grants, current or pending NSF, ACS-PRF. Cottrell applications
- Grant for The Fletcher Jones Chemistry Studio Lab in the new Science Building ($500,000)
- Part of a NASA Educational Equipment Grant in the Science at USF (new 500 MHz Varian NMR, UV-vis, GCs, FT-IR, Raman, GC-MS)

Internal Funding

- Two Lily Drake Cancer Research Grants, Multiple Faculty Development Research, Teaching Effectiveness and Travel Grants

Publications, Meetings, Invited Talks since 2005

- 48 peer reviewed publications since (2006-present) with 25 different undergraduate authors
- 19 Master Thesis degrees
- Numerous Presentations (Faculty and sponsored students): ACS-National Meetings, international meetings, specialized research areas (Gordon Conferences), Annual Bay Area Undergraduate Research Symposium, USF Celebration of Students' Research/Scholarly Activity
- Professional Development/Workshops: POGIL Writing and Labs, Renewable Energy and Medicinal Chemistry (CWCS), Peer-Led Team Learning
- Invited talks: University of Pacific, Sacramento State, Creighton, St. Olaf, U. Buffalo, ZKM Center for Art and Media Karlsruhe, Australian Network for Art & Technology Melbourne, Kiel, ACS National Meetings (Boston, San Francisco, Anaheim, San Diego)

Service Highlights since 2005

- Department Chairs: Castro, Spector, Margerum
- Graduate Program Research Directors: Margerum, Curtis, Meloni
- Student Affiliates ACS advisor: Margerum, Meloni (Student Social Hosts at ACS-San Francisco, Field trips)
- USF Committees: Faculty Development Fund, Scholars Mentor Program, Tenure-Promotion, Center for Science and Innovation, Academic Computing or Curriculum, Students' Research/Science Celebration Day, Dean's Medal, Faculty/staff searches (Biology, Physics, Astrophysics, Director-Grants and Contracts, Chemistry Lab Coordinator)
- Professional Service: Organizer/Host (2007 International Philosophy of Chemistry Symposium at USF, OWL National Faculty Workshop at USF). Referees (ACS, Wiley and Elsevier Journals), NSF and PRF proposal reviewers, Editor (*J. Spectroscopy, Leonardo Journal*)

D. Recommendations and response to 2005 outside review

The department is happy to report that many of the recommendations from outside reviewers have been implemented or are in process. The department felt the reviewers misread some of the issues, but here is what they recommended in 2005:

- The physical facilities must be improved and at least two full-time support staff are needed.
- The Department should develop a strategic plan that includes a collaborative curricular assessment and a consensus vision for the department's future.
- The department needs to employ a greater variety of teaching strategies and more curricular variety (e.g. using technology, partnering with biology, emphasizing premedical options, etc.).
- The next faculty position should be in Organic Chemistry or bio-Organic Chemistry with a strong interdisciplinary character.
- There needs to be greater student involvement in undergraduate research.
- The Department needs to come to an agreement on the graduate program's future.
- The administration should establish an incentive program that rewards faculty for success in procuring grants.

Response to outside review of 2005 by Chemistry

First, new undergraduate lab facilities (for organic, analytical and inorganic) are under construction as part of the Center for Science and Innovation (CSI). Planning is underway to renovate the existing building and most capital needs for equipment have been met (new 500 MHz NMR, new FTIRs, GCs, fluorimeter, AAS, electrochemistry, imager) despite having no departmental capital budget. In addition, dedicated technical staff has increased from 0.5 to 2.0 FTE (Full time stockroom, full-time organic lab coordinator that includes one-third NMR maintenance/training).

Second, in spring 2011, we finished our first 3-year program assessment cycle for BS/MS programs. After data analysis, we spent time as a department last summer and fall to create a new mission statement and new leaning goals/outcomes for the BS program which are included in a following section.

Next, since the reviewers did not attend any classes they seem to have missed many of our lecture/ interactive problem solving approaches in the classroom (65 min seat time for MWF classes). For years, it has been standard policy to move beyond the lecture-only format and have students spend time solving problems (individually or in groups). Some of us also started using iClicker voting systems in lower division sections. Most of our courses have on-line assignments, labs that focus on inquiry-based learning, pre and post assessments and lab practical exams. Therefore, the department feels good about having both formal and informal active learning environments in all lecture and lab courses.

Curricular changes since the last program review did occur: we started a rotating special topics course (Solar Chemistry, Medicinal Chemistry and Reaction Mechanisms Spring 2011-2013); we streamlined biochemistry concentration and minor requirements; we developed multiple new experiments in all lab courses; we substituted genetics (housed in biology) for our in-house 2-unit biochemical genetics course; we now require at least 1 unit of undergraduate research (Chem 397) for our ACS certified majors (typically 6-10 USF undergraduates work on research projects during the semester and summer months.) In addition, General, Analytical and Organic professors held separate planning meetings in 2008 that lead to revised labs teaching assignments/rotations. Most instructors in General chemistry implemented iClicker voting systems after a one year test. One general chemistry faculty member each semester is charged with setup and oversight of OWL on-line homework for all sections.

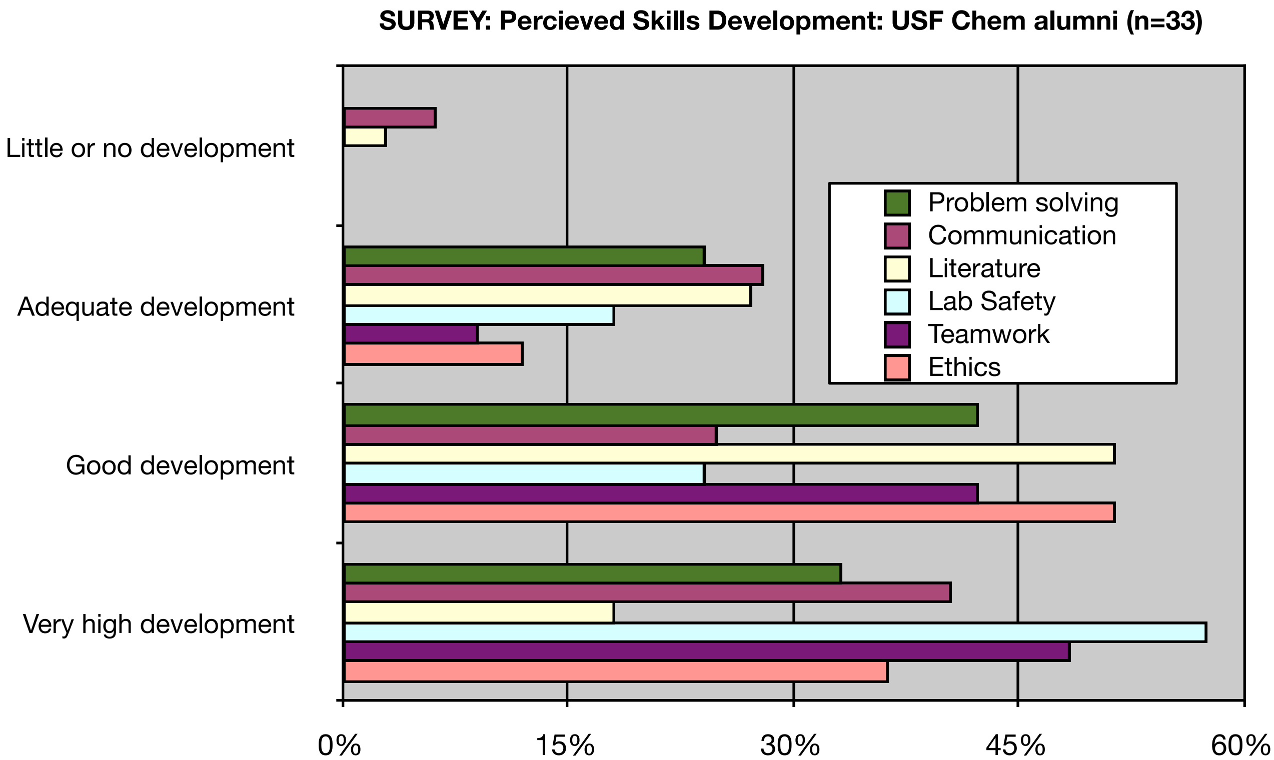
The department replaced retired faculty Theo Jones (biochemistry, spring 2005) with an assistant professor of Organic Chemistry who left after two years due to low teaching evaluations. Megan Bolitho (bio-organic, fall 2009) was subsequently hired as assistant professor. Tom Gruhn retired (physical, spring 2006) and after a failed search the first year, we hired assistant professor Giovanni Meloni (physical, fall 2008). These delays in hiring set back implementation of many new plans, yet has resulted in a more diverse mix of faculty and research areas.

One issue the department resolved (but was missed by the reviewers in 2005) was departmental agreement about the value of the MS Program for those participating. There was strong consensus that taking new MS students should be encouraged, but not required. An incentive was established (rotation into Chem 698:Research Methods) and our new hires work with MS students in their research groups. All faculty agreed to work with our MS students as TAs in lab courses and as heavy users of our combined teaching/ research instruments. Our TA salaries, the main support for MS students (tuition is waived), remain at $7200/year, the same as 2005 (an embarrassment to the department when recruiting students).

Finally, the administration established a Contracts and Grants office and instituted a policy to support course release in grants. The internal faculty development grant rules were modified at our urging such that paid student research hours ($11.47/hr undergrad, $13.44/hr for grads-includes 12% benefits) can be increased somewhat beyond 300 hrs/year/PI. Typical internal research grants or seed funding are now averaging about $3000-4000 per cycle in chemistry (FDF funds twice a year for research, travel and teaching effectiveness). Some faculty are able to supplement the MS TA salary using FDF, but with summer research groups averaging 3-5 students, this does not go far.

The Chemistry department is generally pleased with the additional support that the University and the College of Arts & Science currently provides, yet strives for further improvements. **The faculty in the Chemistry Department wish to make it clear in this report that we feel good about what we and our students have accomplished.**

Our BS and MS alumni (since 2005) also feel prepared as chemical professionals based on a 50% response rate for our on-line survey (see Appendix). **The American Chemical Society has identified a set of skills needed to become successful science professionals.** These skills, termed process skills, soft skills, or employability skills, share the characteristics that they are generic and transferable, are marketable and lifelong, and have wide applications that go beyond course content alone (*ACS publication CNBP_025490*). We asked alumni to rank each skill regarding their USF Chemistry experience from coursework, labs, research or informal interactions with the faculty and staff in the department. The results summarized below show that alumni gave us some mixed messages, but very high marks for developing Lab Safety and Teamwork followed by good development of Ethics and Chemical Literature. We can improve in the areas of Problem Solving and Communication skill development.

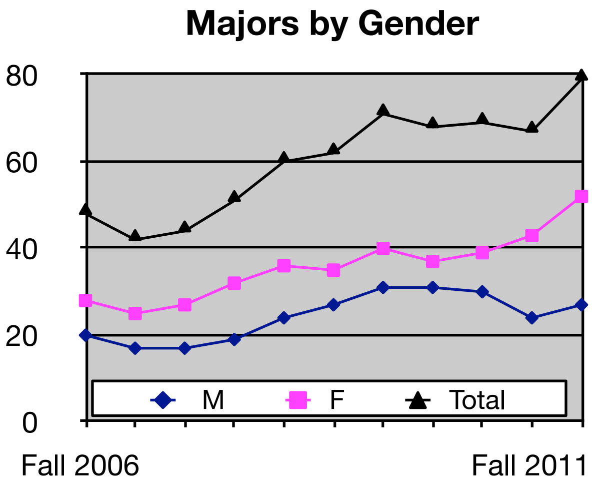


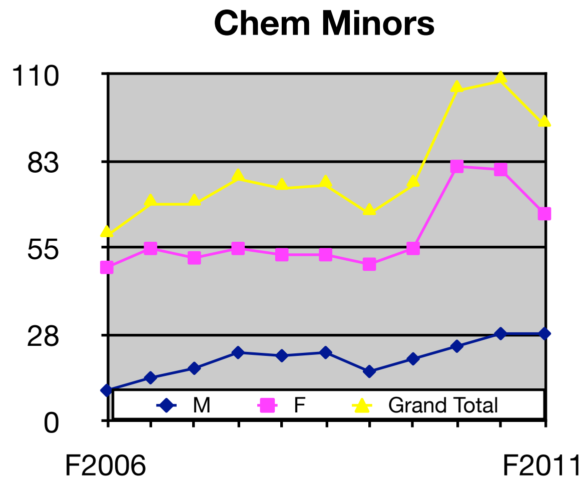
Our Department is working together as we integrate all the above changes and make future decisions based on mission, goals and student opinion. We also want to be even better as outlined in our Future Plans. The long-term make up of the department is already changing as two faculty are on reduced teaching loads (Castro, Curtis), we expect our two assistant professors to apply for tenure and promotion and several retirements may occur in the next 3-5 years.

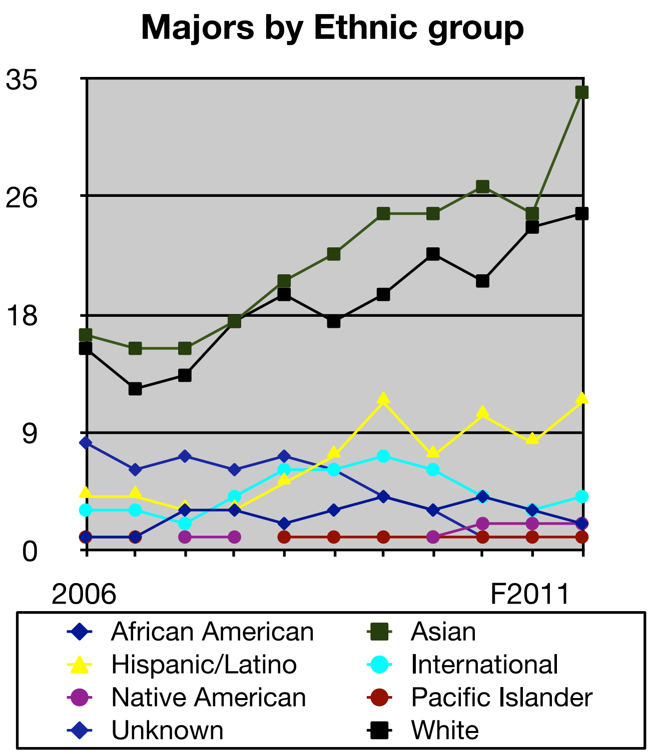
II. Curriculum

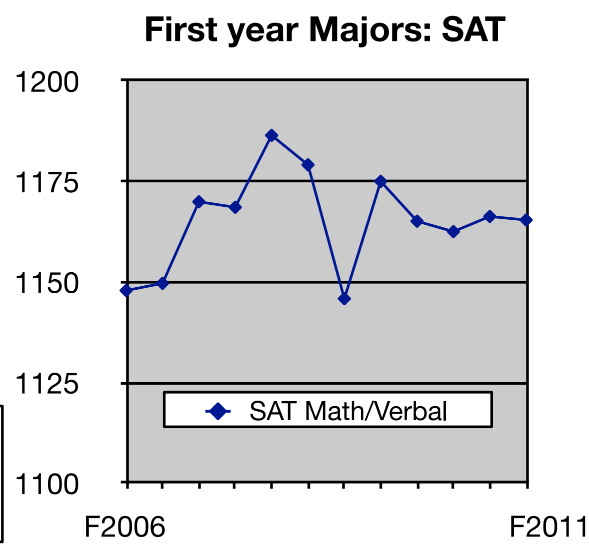
A. Introduction

Degrees. We offer the Chemistry major and minor, Chemistry with Biochemistry concentration major and minor, plus an MS degree in chemistry. Both undergraduate major programs can be upgraded to ACS Certification by adding the capstone Integrated Lab 410 and Chem 397 undergraduate research. Our academic programs are distinguished by small upper division lab courses or small research projects led by professors using advanced instrumentation and techniques. The following data plots summarize some of the changes taking place since 2005.

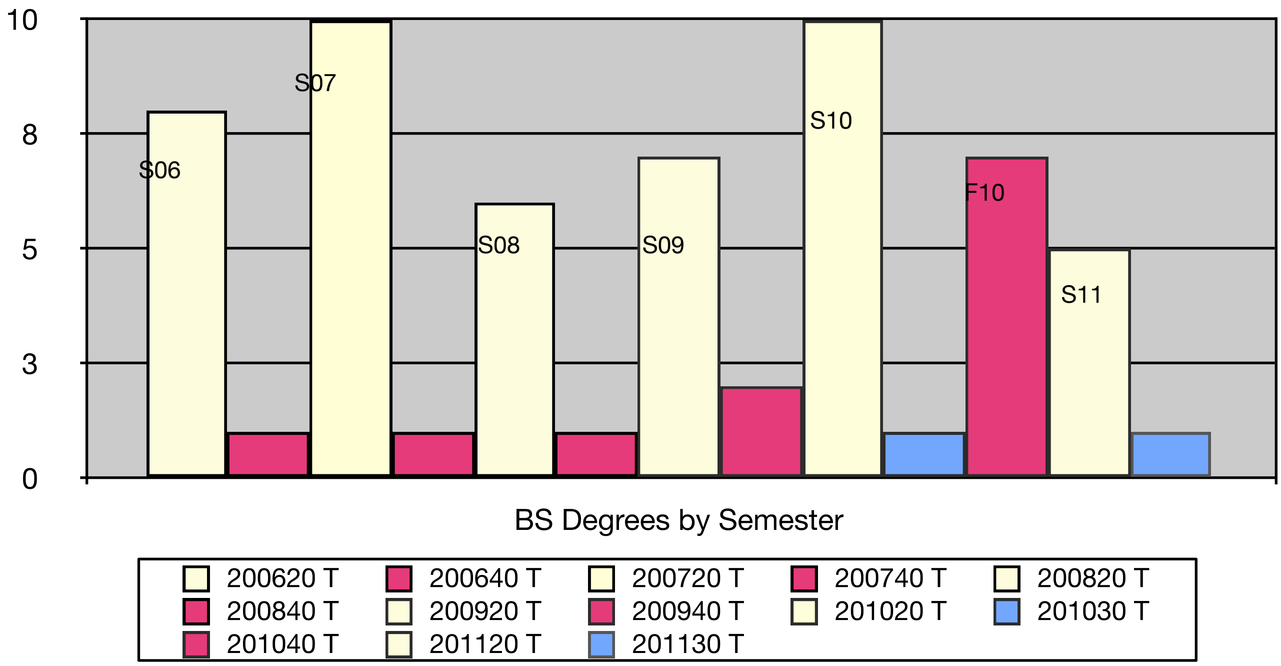








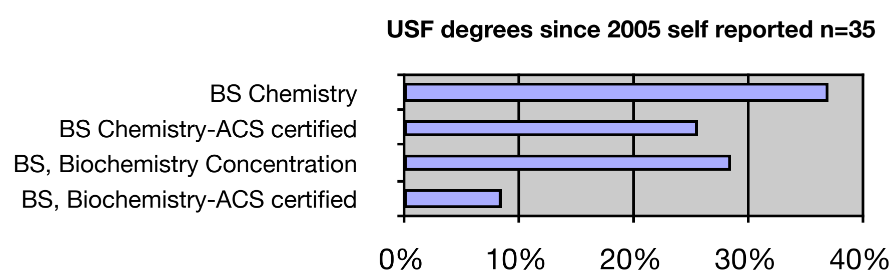
The upper left plot shows the increase for total majors per semester (includes Biochemistry concentration) is about +60% since F06 while the upper right plot shows +90-100% for minors since F06. Women outnumber men in the major and minor programs consistently. The plot "Majors by Ethnic Group" suggests that these increases are due to increasing numbers of self-identified Asian, White and Hispanic/Latino declared majors. We would like to see increasing SAT scores for our first year majors, but this change is a bit out of our control. Our challenge is to increase the number of capable chemistry majors by encouraging those students who demonstrate the ability and interest to choose chemistry. Conversely, we need to advise those out of the major who are better suited elsewhere. While we recognize that enrollment in our major and minor programs may be reflective of a general national trend (more students focusing on preprofessional studies), we also feel that some of the increase is due to changes we made in the curriculum. These numbers will likely level off in the next 3-6 years. The new science building (Fall 2013) may also affect enrollment that we cannot predict, but could potentially increase these numbers further.



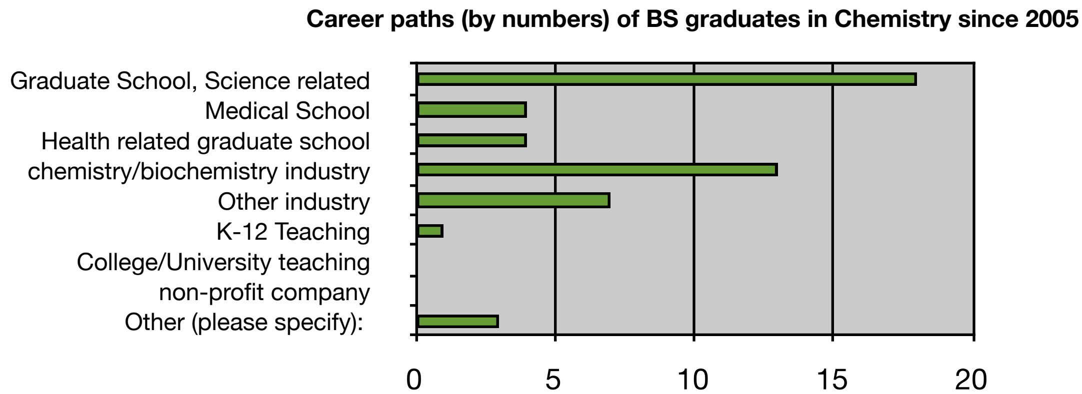
As shown above, BS degrees (all types) vary between 5-10 each spring (in Yellow, code YEAR20) and 1-2 in fall (in Red, code YEAR40, except F10 with 7 graduates; blue, code YEAR30 is summer). We expect a general increase in degrees per year as the large wave of new majors that started F10/F11 finish their four years in S14/S15. Our challenge will be to encourage those students who demonstrate the ability and interest to finish the degree and advise those out of the major who are better suited elsewhere.

Based on our own tracking data since 2005, approximately 15 out of 71 BS graduates (21%) went on to graduate school (MS/PhD in chemistry, 1-2 in environmental science),, about 12% to medical/pharmacy professional school and the rest to industry (or we have not been able to contact). *Approximately 25% of MS graduates went on to graduate school (MS/PhD in chemistry, counting students who did not finish their MS thesis).*

An online survey of BS graduates (n=35) since 2005 gave the following distribution of USF Chem degrees.



The next chart summarizes what our graduates have done since 2005 (multiple selections possible, see appendix for full survey).



B. Undergraduate Program: Course descriptions

The course sequence for Chemistry majors, followed by required courses for Biochemistry concentration, is presented below. Summaries include updates to curriculum and labs since the last review, class/lab size, writing assignments, policies and practices. We accept AP credit for General Chemistry with a 4 or 5 score and routinely accept community college transfer credit for most courses in the first two years.

General Chemistry I (Chem 111/111L, 3 x 65 min lecture and 4 hr lab, Fall 4 units), pre-req: SAT Math 530 or ACT Math 22 or USF Placement Math 20 or CHEM 001 with a minimum grade of C.
General Chemistry II (Chem 113/113L, 3 x 65 min lecture and 4 hr lab, Spring 4 units), pre-req.:Grade of C or higher in Chem 111.

Rotations: Curtis, Margerum, Melaugh, Meloni, Summerhays; Fill-in: Adjuncts
Since the last review, we added a new faculty member into the rotation (Meloni) and because of the increasing enrollments, our four sections of lecture in fall increased from 40 to 60 students. We use the latest edition of Kotz & Treichel's "Chemistry and Chemical Reactivity" since it most closely reflects our students abilities and our approach to the subject. We are a long time users of OWL (Online Web Learning homework system) with this text and find OWL has saved lecture and grading time, forced students to do their own work and helped student attitudes in the course (anytime/anywhere feedback and review). A planning meeting in summer 2009 lead to a more balanced workload rotation into the lecture and labs (general, analytical and integrated courses), and clarification of lab responsibilities (lab manual, new experiments, TA training, etc...). Some professors have adopted iClickers (a USF standard) to try to increase student interaction since the section sizes are larger than a few years ago. It is also a way of identifying misconceptions and gaps in student understanding, and a way of keeping students motivated and engaged in class. Students are generally enthusiastic about their use in class (survey results). Margerum now runs his Chem 111/113 lecture sections with 13-14 groups of students doing POGIL worksheets *(Foundations of Chemistry* by Hanson). We raised the entry into the General Chemistry to SAT Math 530 or ACT Math 22 or USF Placement Math 20. This has resulted in a noticeable improvement in the quality of the student engagement in class discussions or group work.

There are now 12 sections of lab in Chem 111 and 8 in Chem 113, which are four hours long and run by teaching assistants, most of whom are graduate students in chemistry. These labs sizes increased the last two years from the preferred 18 to 20-22 students. Responsibility for overseeing the TAs/labs rotates among the professors, with lab preparation by the stockroom manager. We made major changes to our laboratory manual since 2006 (Margerum, Meloni), rewriting and reformatting older experiments to increase guided inquiry, introducing new ones, requiring more short report writing (graded by rubric) and custom publishing the manual as a fund-raiser for our student affiliates group. In one project, students evaluate each other's writing by way of pre- and post-lab on-line Calibrated Peer Review, CPR.

Our TA training includes how to get students to share and discuss their data, to make connections, draw conclusions, and ask new questions (not just give answers). We have tried different lab assessments with varying degrees of success (pre-labs by OWL, pre-lab quizzes, lab practicals and lab final exams) depending on the faculty in charge. Our data do not suggest that one approach is better than others, but the lab final forces a review of lab concepts which is good practice. We partnered with the USF Learning Center to provide training for new TAs before fall semester starts.

Typically we need four faculty members to teach the Chem 111/113 lecture and lab curriculum per year. However, in the past few years Meloni has taught an extra section of Chem 111 in the fall which has avoided overuse of adjunct faculty. Regardless of the lecturer, the same topic order is followed. (Summerhays produced a common spreadsheet of assignments), same homework and due dates for OWL, and shared exam questions (most semesters). At the end of the second semester the students take the ACS standardized exam as part of their final exam. Our students generally perform at the national average. We are satisfied with this result since the vast majority of our students in General chemistry are Biology majors, most of whom are destined for the health professions, rather than chemistry majors.

Organic Chemistry I (Chem 230, 3 x 65 min lecture, Fall 3 units); Chem. 113 with grade C or higher.
Organic Chemistry I Lab (Chem 232, 1 x 4 hr, Fall 1 unit); Co- or Pre-req. Chem230/236.
Organic Chemistry II (Chem 231, 3 x 65 min lecture, Spring 3 units); Chem. 230 C or higher.
Organic Chemistry II lab for majors (Chem 233L, Spring 2 units); Chem. 230 and 232 with grade C

Rotations: Primarily Bolitho, Castro, Spector; Fill-ins: Melaugh and Adjuncts

The organic chemistry faculty work together to create a cohesive curriculum, which varies minimally in the subject material covered from section to section and assures our students taking the second semester have been exposed to the same topics at the same depth in the first semester. Towards this end, all organic chemistry faculty use the same texts (Organic Chemistry by L.G.Wade), follow the same order in presenting the material, and have the same learning outcomes for the courses; this is also the case for the first semester organic chemistry lab (Chem 232) although individual faculty often alter a few of the specific experiments. In the Organic Lab II course (majors only) there is more curricular flexibility, although the organic faculty still consult with one-another about changes to the syllabus from year to year.

Organic chemistry at USF predominately serves students in other majors (primarily biology majors and a smattering of students from Exercise and Sport Science and Environmental Science). In recent years the number of biology majors has increased significantly (fall 2010 had 98 students in Organic Chemistry I; fall 2011 had 129). The most significant strain on our organic faculty resources is on the number of organic chemistry lab sections that we must offer. For fall 2011 we had 8 lab sections with 16-18 students per section. For purposes of troubleshooting and safety, these sections are offered only during the day when both the faculty instructor and lab coordinator can be present. The faculty instructor is heavily involved in both guiding the students (with TA help for some sections) through each lab, along with grading and supervising the TAs in their grading.

Organic Lab II for majors (Chem 233) is a requirement in the “regular” chemistry track since students in the biochemistry concentration must take biochemistry lab. Yet, students in the biochemistry concentration sometimes chose to take this lab anyway, especially if applying to professional health graduate schools. The major’s lab includes a weekly lecture, four hour lab, and (typically) an hour of independent work (spectra collection, Spartan calculations) The labs concentrate on advanced experimental techniques, including chromatography, inert atmosphere reactions, in-depth spectral interpretation. In addition, there is often a computational component that accompanies an experiment. Finally, Chem 233 emphasizes lab report writing based on ACS guidelines.

Since our last program review we have had two significant changes for organic chemistry. In 2009 we hired an additional tenure track faculty member (Megan Bolitho) who teaches in both the organic chemistry and biochemistry curricula. In addition, beginning in fall 2010 Professor Claire Castro moved to a reduced teaching load. Although we were pleased to be able to hire Megan to help with the Organic teaching load, between her obligation to biochemistry and Claire's reduced load, we have had zero net gain in organic staffing.

Organic Chemistry II lab minors/non-majors (Chem 234L, Spring 1 unit); Chem. 230/232 with C
Fundamentals of Organic for non-majors (Chem. 236, Spring 4 units); Chem. 113 grade of C-

Rotations: Primarily Melaugh; Fill-in: Adjuncts

Although not required for the biology major, many biology students hope to attend either dental, medical or pharmacy school and wish to take a second semester of organic chemistry lab. To accommodate these students, since our last Academic Program Review, we added 1-2 sections of Organic Chemistry Lab II (Chem 234) for non-majors. Because virtually all pharmacy schools require two semesters of Organic lab, the growing number of USF "pre-pharm" students puts even more pressure on the Chem 234 Lab. For spring 2012, we had a waiting list with priority given to chemistry minors. We now have many more declared chemistry minors, the desired outcome!

The non-majors lab is less intensive and experiments can be completed (including lab write-up) in the 3-hour lab period. For this lab we select experiments that may have greater appeal to biology students.

Changes to the organic curriculum that impact the above courses include: moving prerequisite grades from C- to C, moving the one-semester Fundamentals of Organic Chemistry (Chem. 236) to the Spring semester; and offering Organic Chemistry I and II lecture in the summer (Melaugh). Moving Fundamentals of Organic Chemistry to the Spring allows Biology majors who did not achieve the C grade in Organic Chemistry I (Chem 230) to continue on in their major as they must complete either Organic Chemistry I/II or Fundamentals of Organic Chemistry before taking advanced biology courses.

Analytical (Chem 260/260L, 2 x 65 min lecture, 2 x 3.5 hr lab/wk, Spring 4 units) Chem 113, C

Rotations: Margerum, Summerhays, Fill-ins: Melaugh or adjunct

The Analytical Chemistry class size has increased since the last program review. Then, a typical class size was 14-16; now it is 24 (two lab sections, 12 students). This is the absolute maximum our facilities and equipment can accommodate. The stockroom manager provides lab preparation for the course and an MS graduate student TA supervises each laboratory section, working closely with the faculty member in charge.

The longtime textbook for the course is Exploring Chemical Analysis (D.C. Harris) with the lecture and laboratory covering quantitative analysis, equilibrium, statistical/error analysis and instrumental methods for polyprotic acid pH titrations (LabQuest data collection introduced in 2007), GC, AAS and UV-Vis as well as bioanalytical assays. Students use a custom laboratory manual that combines skill building exercises and data driven laboratory projects such as the project called Sewer Science that combines on-line CPR (Calibrated Peer Review) pre and post lab writing assignments around a multi-metal AAS analysis of waste water (simulated). We increased the lecture time in 2010 to the USF standard of 2x65 min (from 2x50 min). This allows increased problem-solving time. Margerum uses self-produced POGIL (Process Oriented Group Inquiry Learning) worksheets with structured groups, in-class exams that combine scores by an individual and the group, and Blackboard course supplements. Summerhays rotated into the course for the first time in many years in 2010 and used a combination of presentation methods. Both instructors follow the same topic order, use class quizzes to encourage review, and have the students take the ACS analytical exam for assessment (recent average scores are at the national average).

Chemistry majors normally take this course in the spring term of the sophomore year along with General Physics II, with lab and Organic+Lab II for Majors. Thus, students enrolled in this typical curriculum have 14 hours of lab and lab lecture per week. Exacerbating the workload has been the movement in recent years to incorporate more lab report writing into the curriculum as a part of a broader "writing across the curriculum" effort. The department has had initial discussions about moving the Organic Chemistry Laboratory II for Majors or the Analytical course to the junior year as a means to reduce the lab hours in sophomore spring. Efforts are also underway to better coordinate the lab report writing in various courses, to reduce the burden on students. Also, many of the current lab experiments demonstrate important analytical methods applied to real-world problems, but we plan to also incorporate some more grade-dependent "unknowns" for analysis to achieve an analytical result close to the accepted value. This would include lab practicals as a form of assessment and grading.

Physical Chemistry I/II (Chem 340/341, 3 x 65 min, 4 units, no associated labs), pre-req. Chem 260, Physics 210, Math 110 C or higher.

Rotations: Primarily Meloni, Summerhays; Fill-in for 341: Curtis

The two-semester Physical Chemistry sequence is based on the classic approach of presenting thermodynamics, electrochemistry, and kinetics in the fall semester and quantum chemistry, intro to spectroscopy, and statistical thermodynamics in the spring semester.Typical class size is 8-10 students, but in Fall 2011, 21 students were enrolled. Last year, the textbook was changed from *Physical Chemistry* by Atkins to *Physical Chemistry* by Engel and Reid after students' concerns regarding the difficulty of the end-of-chapter problems in the Atkins book. The new textbook has a variety of more "approachable" problems.

In the last three years a major change in the physical chemistry curriculum was the addition of an oral component to the final exam (Meloni). The main goal is to promote studying and thinking about the material in a manner different from the simple memorization of equations and theories. Students need to understand the concepts and be able to explain them to an interlocutor.

In general, USF chemistry students are weak in mathematical reasoning and calculus. For instance, they do not have a firm understanding of partial differentiation of multivariable functions. In addition, students do not seem to retain much material in Math 110 or Physics 210, prerequisite courses. This problem makes the mathematical treatment of thermodynamics a challenge for them. To help with this issue, during the first week of classes, a "calculus refresher" is presented to give the students the opportunity to refresh important mathematical concepts, ranging from limits and derivation to multiple integrals. In the future we hope to address this problem outside of class, perhaps through an on-line tutorial during the summer.

Currently we do not have a separate physical chemistry course for the biochemistry concentration students, who are required to take only the first semester of physical chemistry. This approach results in these students being exposed to only a portion of the topics covered in physical chemistry (e.g., they are not exposed to quantum mechanics and the introduction to spectroscopy). The department has discussed the possibility of a one-semester physical chemistry course that incorporates all these topics with a less rigorous mathematical treatment, but it is not clear that we would have enough faculty or students to support additional physical chemistry courses.

Inorganic (Chem 420/420L, 3 x 50 min lecture, 2 x 3 hr/wk Lab, Fall 4 units), pre-req. Chem 340 C.

Rotations: Curtis, Margerum

This four-unit lecture with lab course is required of all majors and is taken in fall of the Senior year (though some students who fall behind in the sequence take it in the fall of their fifth year). We consider this an in-depth advanced course using Shriver & Atkins, *Inorganic Chemistry* text and a combination of in-house and published lab projects. Foundational topics common to both instructors are MO theory for structure and bonding, Lewis acids-bases, redox chemistry, symmetry, coordination compounds emphasizing spectroscopy/magnetics and organometallics. Topics in the text under *Frontiers* vary by instructor and may include semiconductors, catalysts, nanomaterials and bio-inorganic. The student population varies between 6-14 students, but will be on the high side based on the new student numbers. Most years one or two MS students take the lecture portion of the course to make up for a low entrance exam score.

Both professors use the same topic order, but somewhat different lab projects (lab added for first time in 2003). Students are expected to produce high-quality, "Capstone" lab reports building on their prior ACS report writing in lower division classes. In fall 2012, Margerum experimented with student groups presenting posters on photochemistry projects in a Science Fair format (emphasis on the scientific method) with good success. There are also homework sets (collected and graded) and mid-term/final exams (ACS exam results are slightly above national average) pertinent to the lecture portion of the course. Both professors require the maintenance of a professional-level lab notebook.

Modifications and new synthetic experiments introduced into the course in recent years allowed us to include computational work (Spartan, Gaussian), cyclic voltammetry, FT-Raman/FT-IR, plus standard, dynamic and heteronuclear NMR. Finally, both instructors use the department's Horiba-Jobin-Yvon Fluoromax 4 spectrofluorimeter to do Solar Energy related quenching analysis of the $[Ru(bpy)_3^{2+}]^*$ excited state in aqueous solution.

Integrated (Chem 410/410L, 3 X 50 min, 2 X 3.5 lab hr/wk, Spring 4 units) pre-req Chem 340 C.

Rotations: Curtis, Meloni (Margerum out after 2005), not offered spring 2012

This capstone four-unit lecture with lab course is required for all ACS certified degrees. The course "integrates" both traditional physical chemistry and instrumental analysis lecture material with project oriented labs. The student population varies between 4-10 students and is now offered every other year. Students who take this course are a mixture of juniors, seniors and a few graduate students.

At present Curtis and Meloni bring different perspectives to the course. The text is either "Principles of Instrumental Analysis",by Skoog, Holler, and Crouch, with substantial supplementation in electronics, spectroscopy and NMR material (Curtis) or "Experimental Physical Chemistry," 8th Ed. by Garland, Nibler, and Shoemaker (Meloni). Instructors use a similar set of learning outcomes using common instrumentation and instrumental methods. Students maintain professional-level lab notebooks and produce high-quality lab reports and/or presentations. For example, last year students gave posters at the University-wide Celebration of Undergraduate Research with live demonstrations of lab-built spectrophotometers. Over the last few years our small class size has allowed us to take the class to national meetings in San Francisco, to the Stanford Linear Accelerator and to the Joint BioEnergy Institute. All the students highly rate these field trip experiences.

Recent modifications and new experiments include:

1) Improved electronic design of the detector circuits for home-built UV-Vis spectrophotometer
2) Electrochemistry: differential pulse polarography and square-wave voltammetry compared to cyclic voltammetry
3) Introduction of the FT-Raman alongside FT-IR
4) Introduction of time-resolved emission spectroscopy and quenching measurements
5) A suite of new-generation gradient NMR experiments, (HSQC and GCOSY on new Varian 500) along with more foundational calibrations and 1-D experiments.
6) New emphasis on GC-MS for analysis of methyl-tert-butyl ether and benzene in gasoline.

Curriculum: Biochemistry Concentration

Biochemistry I (Chem 350, 3 x 65 min lecture, Fall 4 units), pre-req Organic CHEM 231/236 with C or higher and General BIOL 105/106 with C- or higher

Rotation: Bolitho; fill-in: Melaugh

Biochemistry II (Chem 351, 3 x 65 min lecture, Spring 4 units), pre-req Chem 350 with C or higher.

Rotation: Cobley

Experimental Biochemistry (Chem 352L, 1.5 hr lecture, 6 hr lab/wk, every other year, Spring 4 units) pre-req CHEM 230 with C or higher, co-req Chem 231.

Rotation: Bolitho

Fundamentals of Biochemistry (Chem 356, 3 x 65 min lecture, Fall 4 units). pre-req Chem 231/236 with C or higher

Rotations: Cobley, Melaugh

For these courses a common set of learning outcomes is maintained while syllabi are prepared independently. In Biochemistry I, students apply basic principles of chemistry (including chemical bonding and reactivity, thermodynamics, and kinetics) to the description of how life works at the molecular level. Particular focus is on chemical structures and biological roles of the four major classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids, with special emphasis on proteins and enzymes. This course usually has 22 – 25 students in a one section, with about a 50/50 mix of chemistry majors concentrating in biochemistry and biochemistry concentration minors (mostly biology majors). Biochemistry II typically enrolls 15-20 students with the same mix of majors and minors and focuses on the major metabolic pathways and the control of metabolism at the nucleic acid and protein levels.

Neither of the two biochemistry lecture courses includes a concurrent laboratory. This is a major change since the last review as one Experimental Biochemistry course (Chem 352) is now offered as a four-unit capstone laboratory course, taken concurrently with or subsequent to Chem 351. This course is currently experiencing a complete revision that began in spring 2010 and will be complete in spring 2012 (Bolitho). The motivation behind this revision was to align our course more directly with biochemistry lab courses offered at comparable undergraduate institutions. To facilitate this alignment, the faculty member delivers a weekly lab lecture and uses wet lab experiments based upon those recommended in O'Farrell's Experiments in Biochemistry, although this is not the only source of inspiration for laboratory exercises. Experimental Biochemistry introduces students to the fundamental experimental techniques behind the purification and analysis of proteins/enzymes and nucleic acids beginning with exercises in essential lab skills and then moving to spectrophotometry, salt fractionation, column chromatography, protein-DNA gel electrophoresis, and activity analyses. This course also incorporates basic computational tools to facilitate search and analysis tasks, and includes the preparation of a formal lab report. Typically, only chemistry majors concentrating in biochemistry enroll in this course. The target enrollment for this course is 8 – 12 students and is offered every-other-spring semester (in even years), barring unusual demand.

Fundamentals of Biochemistry (Chem 356) provides a single-semester option to fulfill the ACS recommendations for exposure to Biochemistry by chemistry majors and for interested biology majors. This course is a survey of biochemical concepts emphasizing the nature of cell components, their interaction in metabolism and the regulation of metabolism.

Biochemical Genetics (Chem 450, 2 unit course by Cobley). Last offered in Spring 2009 and discontinued in favor of course substitution for Genetics Course in Biology (4 units) due to scheduling problems for a 2 unit course and changing faculty workload.

Open to Chemistry and Chemistry with Biochemistry concentration:

Undergraduate Research Methods and Practice (Chem 397, offered every semester, faculty led research, 1 unit, can be repeated up to 4 units), pre-req; permission of the research director

Rotations: Bolitho, Castro, Curtis, Margerum, Meloni

The primary purpose of the course is provide students with a research experience as part of a faculty-led research program. Students must be accepted into a research group before adding the course with priority given to majors who have completed organic or analytical lab work. In fall, students from the different research groups meet periodically with the faculty instructor and evaluate the chemical literature, review safety and give an informal presentation. In addition, the instructor assists students in writing a required research progress report from work completed in fall or the preceding summer. In spring, the faculty in charge of the course assists students in preparing a professional oral or graphical presentation of research for a campus, local and/or national conference. A full written report is required for students in their final semester who are completing the ACS-certified degree. We encourage most chemistry majors to take the course before they graduate, especially if they are considering graduate school. Students often complete two or three consecutive semesters of Chem 397 and enrollments vary between 6-10 students per semester.

There are two issues with undergraduate research in our department: we cannot always accommodate the majors who want to do research on-campus (we prioritize the placement of juniors and seniors) coupled with the lack of research opportunities for biochemistry concentration students.

Both Bolitho and Margerum are part of USF committees to promote undergraduate research presentations on campus and the College recently became an institutional member of CUR (Council on Undergraduate Research).

Chemistry Major/Minor Electives (4 units, lecture only)
Professor Castro's **Chem 330, Chemistry of Drugs** (fall 2005 and 2008) is the only chemistry elective the department was able to offer between 2002-2010 due to faculty workload shortages. This course was very popular with pre-health professional students in other departments and we longed to offer new electives given full staffing. Margerum was able to offer a combined **Chem 386/686: Special Topics: Solar Energy Conversion in spring 2010** to 7 undergraduates and 5 MS students. Based on the difficulty of teaching a chemistry course to majors, minors and graduate students at the same time, Bolitho is teaching **Chem 386: Special Topics: Medicinal Chemistry in spring 2012** for 11 undergraduates only. Our current goal is to offer an elective every spring as a special topics course. To do this, we currently must take faculty out of other courses.

<u>Current Courses for non majors</u>
Foundations of Chemistry (Chem 001, Cobley, Summerhays, Castro ('04), adjuncts) is designed for students who did not place into Chem 111 (General Chemistry I) and is a 4-unit lecture course that reviews high school chemistry and problem solving techniques using the textbook *Introductory Chemistry* by Tro, weekly problem sets and in class problem solving. Students obtaining a C or higher are able to take Chem 113 in summer to catch up in their major (typically biology). Course enrollment increased slightly to 10-15 students after we started enforcing the placement cutoffs in Chem 111.

Evolution and Human Origins (Chem 105/105L, Cobley, 3x 65 min and 2 hr lab) This interdisciplinary lecture with lab course considers and evaluates the evidence that all life forms have evolved from a common ancestor by means of natural selection. It draws upon ideas from biology, geology, paleontology, philosophy and history to gain an evolutionary perspective on what it means to be human. The course is structured historically and presents the key ideas and experiments that laid the foundation for our current understanding of evolution and its mechanisms, followed by how the predictions of the 19th century were explored and tested in the 20th century. In particular the course focuses on how our extensive chemical understanding of life has led to overwhelming support for the common origin of all life and the evolution of life by natural selection and examines fossil evidence, DNA sequencing of extinct forms of Homo. The course concludes with a presentation and discussion of the philosophical, religious, political, social and personal implications of evolution as it relates to the human condition. Field trips during class time include the SF Conservatory of Flowers, the Botanical Garden, the California Academy of Science and the SF Zoo.

Molecular Gastronomy: The Science of the Food We Eat (Chem. 110, Spector, 3x65 min, 2 hr lab)
This new course, first taught in spring 2011 and again offered in spring 2012, fulfills the Core B2 Science requirement and is intended for non-science majors in the Saint Ignatius Institute (USF's Catholic great books program). It is taught by Spector without TAs, and enrolls 16-18 students. The intention of this course it to employ the students' natural interest in food to engage them in science (primarily chemistry) and contemporary issues related to food consumption and policy in the U.S. The course is structured so that

each week students learn about a particular aspect of food science in lecture, do a lab related to the week's scientific topic, and discuss assigned readings from Michael Pollen's Omnivore's Dilemma. Modifications to the course for spring 2012 will include: a greater number of labs that involve the construction of foods rather than focusing on the deconstruction, and analysis, of food components; the replacement of term papers on special topics by student presentations.

Discontinued in favor of Chem 105: **Natural Science, Getting a Grip on Science (Chem 100/100L, Cobley, 3 x 65 min and 2 hr lab, 4 units)** The course was designed to address part of the Content Specifications in Science as required of a candidate seeking a credential as a Multiple Subject Teacher in the State of California. Astronomy and physics were covered first, and then chemistry. These commonalities (facts, hypotheses, predictions from hypotheses, evidence, reason and skepticism) form a thread that runs through the course. In both lecture and lab these commonalities attempt to reveal that science is really a single enterprise.

C. Honor and awards available to undergraduate majors

We have an annual spring banquet celebrating BS and MS graduates and give these awards:

- The CRC General Chemistry Award
- The ACS Polymer Chemistry Award
- The ACS Analytical Chemistry Award
- The ACS Inorganic Chemistry Award
- Department Awards for achievement in Physical Chemistry and Biochemistry
- The American Institute of Chemists Achievement Award, BS Undergraduate
- The American Institute of Chemists Achievement Award, MS Graduate
- Graduate Award for Achievement in Teaching at USF
- ACS USF Student Chapter Achievement Award
- The Mel Gorman Award to the senior with the highest GPA in their science courses
- USF Award: Arthur Furst Award, former Professor of Chemistry Stanford/USF
  Scholarship awarded annually to an undergraduate science major who demonstrates outstanding academic ability and a strong desire to pursue research.
- Two travel awards from department funds to present at national meetings

Self-identified strengths of curriculum:

- Faculty working together to develop a more cohesive curriculum with agreed upon outcomes and assessments
- Ongoing experiment revisions to keep the lab courses relevant
- Good number of majors involved with research
- Placement of high-end students into excellent graduate programs (UCSD, UCLA, Yale, U of Washington, USC, UC-Davis, Arizona)
- Solid ACS program with hands-on work with research level instrumentation

Self Identified Weaknesses with our Curriculum:

- Lack of faculty resources to deliver the increased number of students wishing to take full year organic chemistry labs.
- Lack of student choice for electives (i.e., we are delivering primarily a "bare bones" curriculum). This also ties in with the lack of being able to offer different chemistry concentrations.
- Lack of biochemical research opportunities for both undergraduates and masters students.
- Only 50% of faculty working with undergraduate researchers; <40% with MS researchers
- Poorly prepared students (incoming based on SAT/GPA and continuing poor pre-req course retention)
- No graduate level courses for students

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D. MS Program

1. Mission, Background, Admission and Student Financial Support

The Chemistry Department currently offers a full time Master of Science degree in research groups doing Analytical, Bio-organic/Chemical Biology, Inorganic, and/or Physical Chemistry. The mission of the program is similar to the BS program, except on a higher, less-structured level.

Mission: *To deliver a broad-based, challenging research experience that will train students to participate effectively as PhD researchers, health professionals, government and industry professionals, or as teachers. The program will foster a culture that: values strong researcher-faculty-staff interactions and strives to help researchers become self-learners and to discover the excitement and creativity of chemical research. We strive to instill values of social responsibility with ethical behavior as part of a chemical research community culminating in the writing of a research thesis.*

Our research-based thesis MS program differentiates us from other local MS programs that are course-based (San Jose State, Cal-State East Bay, some students at SF State) or are part of PhD programs (Stanford, Cal, UC-Davis,U of Pacific). The college has an Office of Graduate Programs that helps us produce a brochure, conducts mailings, open houses, and guides students through the application process. We detect an increase in domestic applicants since this office went full time in about 2005. The chemistry graduate program director (volunteer position with no course release) works with that office and the department administrative assistant to review applications, screen them for qualifications and pass selected files to other research directors for review. Students are admitted using multiple criteria and only if there is a match in a research group. There are March deadlines for fall and October for spring semesters. Students must have the equivalent of a BS chemistry degree with GPA 3.0 or higher, GRE general test and we highly recommend the GRE Chemistry subject exam. Most admitted students have research experience. In many cases our overseas applicants have difficult-to-evaluate transcripts. For these applicants we look for research experience, teaching or tutoring experience, plus minimum GRE scores of > 400 Verbal, 550 Quant, 3.0 Writing, and >90 computer-based. The graduate program director conducts phone interviews with all ESL students before offering a TA position.

Once in the program, students take two or more ACS standardized exams and must score above the 60th percentile. Most students pass one or no exams and must take an upper-division course to satisfy the requirement (we also require a course of study for retaking the test if a course is not offered). If a student does not meet these requirements and are not making progress in research, they are asked to leave at the end of the second semester, although this is rare (2 students in the last 7 years by mutual consent). Students are limited to 6 units/semester (minimum 24 total units to graduate) and fulfill this with Chem 698: Research Methods/Practice, and Chem 699: Thesis Writing in the last semester. There is a Chem 698 workload credit for MS research active faculty in spring only (currently 4 out of 8 tenure track). The class meetings are devoted to improving communication skills, giving presentations and informal preparation for the job market in concert with the research director. *We have not offered a graduate level elective course since 2003 due to faculty shortages*.Faculty participants in the MS program value the close mentoring relationship with students and generally feel that a year round presence of graduate students adds to the undergraduate research experience.

USF does not give stipends to graduate students, only an hourly wage for TA work. Our students receive 6 units/semester tuition remission (program limit of 20 students set by the administration) and those with adequate spoken English receive two semesters TA salary ($7,200 a year; additional TAs are hired for summer courses).

Current USF compensation formula for MS Chemistry students

Teaching, grading and research	Fixed Student Help Rate	Total: 15 weeks/semester X 2
20 hours limit/week	$12.00 hr	$3600 x 2 = $7200 per year

MS students do not register for classes in summer, but generally do research full-time and are not paid, unless the PI has outside funding. Obviously, this is not an inviting financial package and student recruitment is an ongoing challenge given the cost of living in the city. We conducted a comparison of our financial package to a set of comparator schools, which shows our support levels are at least 30% below average (**Appendix**). Possible ways to increase the TA salary have made little progress over the years, so we are looking at other sources of paying for student research, such as larger donations to the "Departmental Gift Fund" for research awards (initial talks with the Advancement Office were encouraging, but no efforts have been launched), securing more external funding for summer research salaries (these tend to be PI dependent and do not benefit all MS students) and increase the research assistant hours limit of 150 hours/ Faculty/semester via the USF Faculty Development Fund. We were successful in obtaining an increase in hours on a case by case basis starting in 2010 (pay rate still limited to $12/hr+benefits and outside letters of support required for requests over $4000/semester). What is needed? In our view a 12 month stipend-based system with yearly cost of living increases seems the standard practice and would help us in recruiting and retention (please see Appendix for comparisons to other schools on MS financial packages). We are open to any suggestions on how to fund this program to a reasonable level.

2. Program requirements, departmental resources

To complete the MS degree students must write a thesis on their original research that involves multiple drafts/revisions by the research director, reading by two faculty members for purposes of refinement and quality control, printing and submission to the Dean and the Library. This is the most difficult requirement and we require a draft thesis be in place before students apply to graduate. Some students accept jobs or go to PhD programs promising to finish the thesis on time, but about 10-15% of students who complete the research do not finish or submit their thesis. Other requirements include presenting a seminar to the department and submitting research progress reports as part of the Chem 698 course. Most graduate students present posters at least once at regional or national meetings, but we have difficulty funding graduate student travel. The department partly addressed this by using budget dollars or gift funds to sponsor travel awards for one MS and one BS student each year.

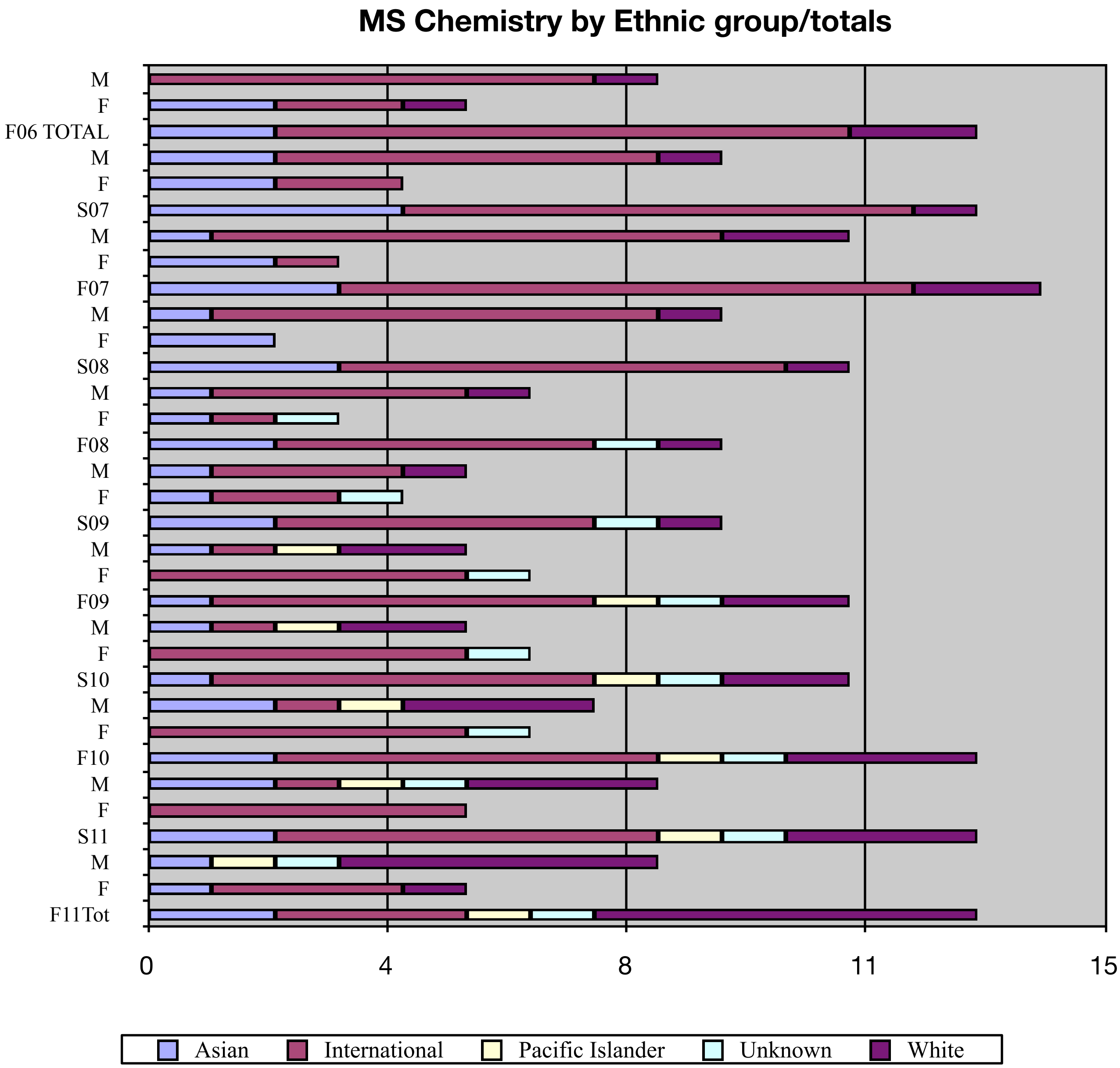
The research active faculty train students in the lab and on instruments, while our new lab coordinator and the USF Environmental Safety office conduct safety training. We are satisfied with the research equipment available in the department despite the lack of a capital budget. The College obtained a NASA Teaching and Research Instrument grant and other foundation grants around 2008 that resulted in a new 500 MHz NMR, a new fluorimeter, new FT-IRs and Raman, replacement UV-vis and upgraded GC-MS. Since 2003, individual research grants (primarily NSF) and start up funding have resulted in a new AAS, electrochemical instruments, a bio-imager and plate reader and a computer cluster. There is now a full-time stockroom manager, but we lack a dedicated instrument manager for research students (we use service contracts, part-time troubleshooting by the organic lab coordinator and the college technical manager). *We are happy to announce that the college responded to a chemistry department proposal to hire a new instrument specialist for lab sciences, starting fall 2012, as part of the new Center for Innovation and Science (CSI) building.*

3. MS Students

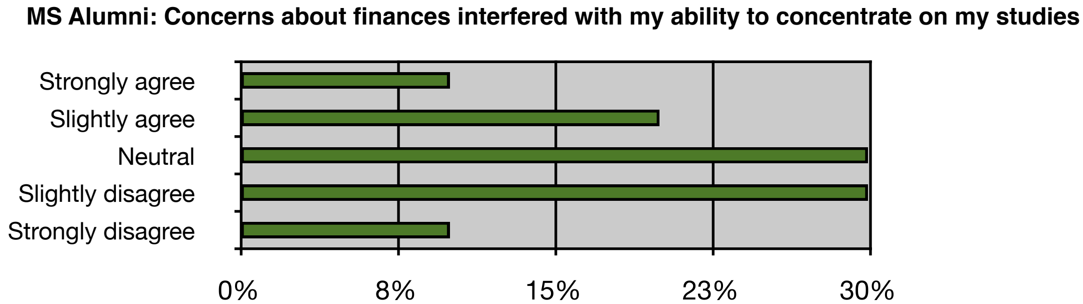
The graph below shows the total students in the MS program each semester and the gender/ethnic makeup since the last review. The dip in totals from S08 to F10 was partially due to the delay in hiring Meloni and Bolitho. The numbers are very small for detecting any major trends since the last review. There seems to be a smaller percentages of self-identified Asian/International categories and we have about 20% more domestic applicants and admits (data not shown). Of course domestic applicants are easier to evaluate by transcript and for possible TA positions. These applicants self-identify in some of the nonwhite ethnic categories.

The quality of student entering the program is uneven (see **Appendix, MS Assessment:Fall'09**: only 2 of 16 ACS exams were passed at >60th percentile). Most students who apply could not get into PhD programs, but view an MS as a pathway to that goal. Some do not want a PhD program or are working, but desire additional research training. Although our tracking is not complete, >95% of students who complete the research (thesis or not) have chemistry related jobs or get into PhD programs (recently, Purdue, Maryland, USC, St. Andrew's-Scotland, UCSD, Washington, Rochester, UT-Dallas). With the caveat that some students volunteer to leave, or stay for 3 years but do not submit a thesis, about 80-85% of entering students leave with an MS degree. The countries/US undergraduate universities represented by our students since 2006 is impressive for a small program: India, Pakistan, Ireland, Poland, Peoples Republic China, Taiwan, Wittenberg College, UCSD, USF, St.Mary's, UC-Davis, CSU-Fullerton.

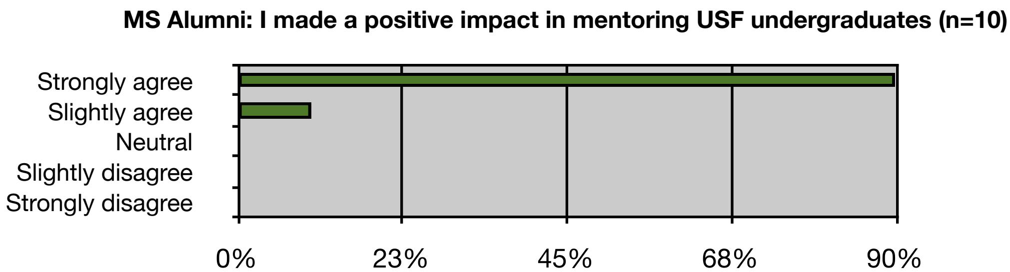
The main desire for faculty in the MS program is to increase the financial package to students. As outlined above the current USF model for graduate programs (working adults pay full tuition) does not work in lab sciences. Our location and the Bay Area high-tech job market certainly help attract applicants that have their own source of funds, but many students must find outside jobs to stay in school.

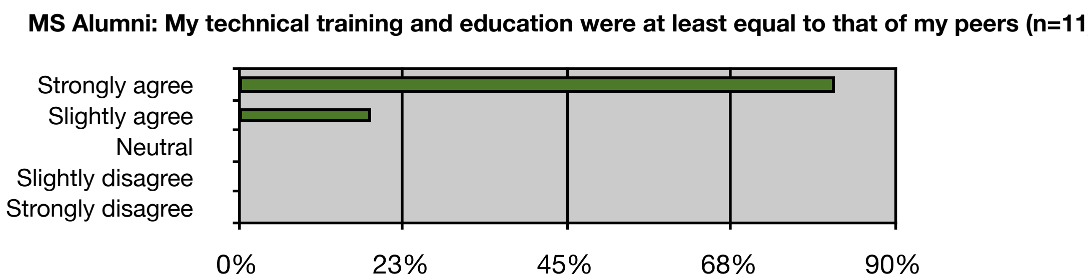


An MS Alumni survey (see **Appendix** for full survey) gives us more insight into our MS students (n=11, 50% response). The data indicate about 30% (strongly/slightly) agree that financial concerns interfered with their studies.



As a department, we value the role our MS graduates play as TAs and mentors to USF undergraduates. Our MS graduates agree they had an impact. (see charts following, and note in the full survey that 90% of respondents felt very positive about their graduate experience).





E. Undergraduate Advising

Declared incoming chemistry majors are assigned a faculty advisor based on the concentration they have chosen in the major (Chemistry or Chemistry with Biochemistry). We attempt to evenly distribute the advising load among all tenured and probationary faculty in the department. Since it is a small department all chemistry majors are required to meet with their advisor twice a year. These meetings occur a week before class registration for the following semester. To assure that all students attend an advising session the on-line class registration system will not allow them to register for classes until their advisor has removed their hold. Advising involve helping students determine which track is appropriate and to assist in selecting courses for the next semester. One of our primary aims is to make sure they stay on track in the major and with their University core requirements so that they can graduate in four years. This goal is facilitated with check-sheets for the major tracks (with and without ACS certification) and the University core requirements that both faculty and students have access to (these are available on-line and student advising folders and schedules are prepared by Deirdre Shymanski, the program assistant.

Over the years we have developed a strategy to identify those students who might not successfully complete the BS program (2.0 GPA minimum in the major to graduate). Our program assistant tracks the success of our students with an annual inventory of all of major's GPAs. In addition, once per semester, there is a department meeting in which faculty discuss the best course of action for those students who are poorly performing in their classes. In the past we attempted to deal with such students by requiring them to meet with their advisors, the Department Chair, and, in particularly vexing cases, asking the Dean's office to intervene. Despite these efforts, in recent years, some students did not improve their chemistry GPA and/or refused to change their major, convinced that somehow they will redeem themselves. Sadly, in a small number of cases this led to the unfortunate situation of a student taking four years of classes without ultimately earning a USF diploma. As a result of this and based on tracking data, we agreed on standards and rules in 2010 that require students who are struggling in the major to either improve their GPA or choose a more appropriate major earlier in their college careers. For example, we email our majors an advising letter that reminds them of major requirements, course and grade pre-requirements (now a C or above for all courses) and we implemented a new "two-strikes rule" (required courses for any chemistry major can only be taken twice). If the minimum required course grade to progress on to the next course in the major is not achieved on the second attempt, the student must change his or her major. The department agrees that these changes set clearer expectations and allows us to advise struggling students out of the major.

Along with teaching our classes and mentoring students in research labs, many members of the faculty view themselves as professional role models for our students. As a small department, many of our majors are involved in research with chemistry faculty and/or serve as TAs, lab preps or stockroom and office help. Thus, there is ample opportunity for less formal interaction with students. Whether formal or informal, advising plays an important role in our department beyond simply keeping students on track in the major. Majors often seek advice about study abroad, internships, jobs and their career paths after graduation, including specifics about graduate programs in chemistry. Ultimately, we aim to help each of our students succeed as chemistry majors while at USF and to find a professional or career path that is appropriate for them, whether as a technician in an industrial lab, pursuing a degree in pharmacy, or a Ph.D. in chemistry.

III. Assessment

After three years of collecting assessment data (fall 2008-spring 2011) we concluded that students were meeting our standards in most areas (see **Appendix**), but we identified other shortcomings like poor retention of previous course materials. The entire department discussed and rewrote the BS assessment document in summer/fall 2011 using learning outcomes from the ACS-CPT ("*Promoting Rigor in the Curriculum*") and comparator institutions.

A. BS Program Learning Goals (2011-):

- To offer a coherent program of course work in the core areas of chemistry and biochemistry that provides a modern foundation for subsequent in-depth course work or research experiences
- To challenge student teams with hands-on laboratory and computational experiences, using modern, sophisticated instrumentation supported by qualified staff, that encourages students to extend their chemical understanding via the scientific method
- To emphasize the building up, retention and transfer of scientific concepts and skills throughout the curriculum, where faculty members accommodate a variety of learning styles and use personalized feedback to help students become responsible problem solvers and self-learners
- To foster a community of chemists that values the excitement and discovery inherent in teaching, learning and researching all the areas of chemistry and biochemistry.
- To help students attain the professional skills necessary to succeed in their chosen career with an integration of safe, ethical and socially conscious behavior.

B. BS Program Learning Outcomes and Methods (2011-):

1. **Students will demonstrate their mastery of the four principle disciplines: analytical, organic, physical, and inorganic Chemistry. (Bloom's Terms: Knowledge, Application)**

   Nationally Normalized American Chemical Society (ACS) exams in Chem 113, 260, 420: Benchmark is the National Median (varies by exam). Embedded final exam questions: Chem 230/231 and 340 (benchmark > 60% correct). For Chem 350/351 (same quiz/same students: in 350 and post 351: Benchmark: 70% correct)

2. **Students will recognize and understand the concepts and skills learned in prerequisite courses at or before the start of the new course or laboratory (Knowledge and Comprehension)**

   Required Pretest and posttest/problem set at the beginning of the course: Benchmark established by instructor is generally pretest: 60% or above and retake/posttest after 2-3 weeks of class (generally >80% correct). Subject to revision as more data are collected.

3. **Students or student teams will demonstrate excellent problem solving skills in performing a broad variety of analytical, computational and synthetic procedures using proper safety protocols, and will critically evaluate the results (Application, Synthesis and Evaluation)**

   Lab practical or written report of activities scored by rubric. Benchmark 65% or above. Laboratory safety map and quiz: Benchmark 90% or higher.

4. **Students will demonstrate effective scientific communications skills in both written and oral form. Students will be able to write reports and present results while following professional policies regarding intellectual property, plagiarism, and ethical group work. (Comprehension and Analysis)**

   Poster presentation rubric: Benchmark: "Meeting Standard" in 8 out of 10 categories. Oral presentation rubric: Benchmark: average of 3 over ten categories (scale of 1-4). Standardized Professional Lab Report format adopted in lower division courses: Benchmark 65%

5. **Students will apply their experience and knowledge of the discipline in the successful conduct of at least 80 hours of in-depth work via undergraduate research, experimental biochemistry, integrated lab or chemistry electives. (Knowledge, Application, Synthesis and Evaluation)**.

   Capstone project presentation or progress report: Presentation at regional, national or departmental meeting: Poster presentation rubric: Benchmark: "Meeting Standard". Indirect measurements: Tracking hours, presentations, reports, Student Assessment of Learning Gains (SALG) exit survey (www.salg.org)

C. MS Program Learning Outcomes and Methods

1. Students demonstrate a broad knowledge in areas of chemistry relevant to their research interests.

a) Students will score at or above the 60% percentile on two American Chemical Society (ACS) subject exams by the end of their second semester on campus, b) Students will organize and summarize relevant resources in the chemical literature pertaining to their research area via progress reports and/or a research thesis

2. Students will become safe and proficient in laboratory practice and instrumental techniques necessary for their research area.

a) Students can safely operate and analyze results from research quality instruments necessary for their research project, b) Students practice and/or enforce safe laboratory techniques, including waste disposal procedures, during their teaching and research projects

3. **Students will be able to communicate the subject of chemistry, especially their own research project, in written and oral forms including: correspondence, reports and short presentations that may utilize multimedia tools that support effective communication**
   a) Students will exhibit and employ good communication and teaching practice as assistants in undergraduate laboratories, b) Students will exhibit the ability to prepare professional reports and/or multimedia presentations in formal (seminars, courses, professional meetings) and informal (group meetings) settings, c) Students will exhibit the skills and competencies necessary for professional and effective oral presentations.

4. **Students will become critical thinkers who are able to judge scientific arguments and make their own arguments based on experiments conducted during their research project**
   a) Students will be able to discuss, in a written research thesis or scientific publication, a clear understanding of their research problem, other perspectives, key assumptions, data collection/analysis and conclusions.
5. **Students who graduate with an MS degree in chemistry from USF will be well prepared to pursue further graduate studies or employment in chemistry or related scientific fields.**
   a) Students will formulate and execute a plan to identify and secure a position in industry or academics, b) Students will obtain appropriate entry-level scientific jobs with reasonable chance for advancement or will be accepted into PhD programs in chemistry related fields.

The latest Assessment Reports are in the Appendix

IV. Faculty

The chemistry department currently covers all sub-disciplines of chemistry in teaching and in some research projects (analytical, biochemistry, inorganic, physical, organic/computational), with many of us having overlapping interests in more than one area. Here, we will focus on faculty teaching workload, research and faculty development.

A. Teaching

The department chair runs the teaching workload discussion and is responsible for submitting final documents to the college administration. Over the years the chemistry faculty have collaborated to find a fair balance of workloads in our disciplines in conjunction with the union contract that calls for a two year sequence of 8-8-8-12 units/semester. The department has course rotations and workload credit for many different situations: from 'normal' 3x65 min MWF lecture only courses, to oversight of labs in large lecture-lab courses, to running an entire lecture-lab course. We generally try to have faculty in most lecture-lab courses for two straight years to cut down on the preparation time. We try to balance a large lecture course assignment with a smaller lab or course in the same semester. The chart below summarizes these assignments for the last two academic years, F10-S11 and F11-S12, along with columns for Student Credit Hours (SCH) and Faculty Contact Hours. For the most part faculty contact hours = workload units. The far right column summarizes how many times the faculty member taught the course, including multiple sections in the same semester.

Please note in the table below that we hired adjunct faculty or had faculty overload to deliver some basic core courses. To ease the transition, we worked with our adjuncts and junior faculty on an informal mentoring basis to share philosophy of teaching and TA training, syllabi and lab experiments and grading practice the first time through a course. Once established both of our new junior faculty implemented new lab experiments or approaches that have enriched our students'. We have also taken faculty out of some courses to offer a Special Topics course each spring (chemistry elective for both majors and minors). At this point, most of the faculty believe we are offering all required courses very well, but we can only offer a bare minimum of optional chemistry courses and zero graduate courses.

Courses in Chemistry	Fall '10 and '11	Student Credit Hours SCH	Faculty Contact Hrs/wk	WKL units	Last 2 years (# times)
Grip on Science	Chem 100 and 100L	**4**	**5**	**4**	F 10 only Cobley (1 section)
*General I Lecture	Chem 111 (4 sec)	**4**	**4**	**4**	Meloni (2+2 overload), Curtis (2), Melaugh(2), Summerhays (2)
* +General I Lab (TAs)	Chem 111L (12 sec)	**0**	**2-4**	**4**	Meloni (2)
Organic I Lecture	Chem 230 (3 sec)	**4**	**4**	**4**	Spector (3), Bolitho, Adjunct
Organic I Lab	Chem 232 L (8 sec)	**1**	**1 lec, 4x4 hr labs**	**12**	Bolitho(1), Melaugh (1), Adjunct(4 units)
Physical I	Chem 340	**4**	**4**	**4**	Meloni (2)
Biochemistry I	Chem 350	**4**	**4**	**4**	Bolitho, Melaugh
Fundamentals Biochem	Chem 356	**4**	**4**	**4**	Cobley (2)
Research Methods	Chem 397	**1**	**variable**	**4**	Curtis, Meloni
*Inorganic Lecture	Chem 420	**4**	**4**	**4**	Margerum (2)
*+ Inorganic Lab	Chem 420L (1 sec)	**0**	**6**	**4**	Margerum (2)
Graduate Research	Chem 698	**2 to 6**	**variable**	**0**	No credit
	Chair		**3 staff**	**5**	Spector, Margerum
*** Combined Lecture/Lab**	Sabbatical Leave			**16**	Castro, Summerhays

Courses in Chemistry	Spring ‘11 and ‘12	SCH	Faculty Contact Hrs/wk	WKL units	Last 2 years (# times)
Foundations	Chem 001	**4**	**4**	**4**	Cobley, Term
Evolution Human Origins	Chem 105	**4**	**4**	**4**	Cobley (2)
Molecular Gastronomy	Chem 110	**4**	**4**	**4**	Spector (1 + 1 overload)
*General Chem II	Chem 113 (3 sec)	**4**	**4**	**4**	Meloni, Summerhays, Margerum, Melaugh, Term (2)
*+ General II Lab (TAs)	Chem 111L (10 sec)	**0**	**2-4**	**4**	Melaugh (2)
Organic II	Chem 231 (2 sec)	**4**	**4**	**4**	Spector (2), Castro, Adjunct (1)
Organic II Lab Majors	Chem 233 L (1 sec)	**2**	**~5-6**	**4**	Bolitho, Castro
Organic II Lab NonMajors	Chem 234 L (2 sec)	**1**	**~4-5**	**4**	Melaugh, Adjunct
Fundamentals Organic	Chem 236	**4**	**4**	**4**	Melaugh (2)
*Analytical	Chem 260	**4**	**2**	**2**	Summerhays, Margerum
*+ Analytical Lab (TAs)	Chem 260L (2 sec)	**0**	**2-4**	**2**	Summerhays, Margerum
Physical II	Chem 341	**4**	**4**	**4**	Meloni (2)
Biochemistry II	Chem 351	**4**	**4**	**4**	Cobley (2)
Biochem Lab	Chem 352	**4**	**5**	**4**	Cancelled and Bolitho S12
Research Methods	Chem 397	**1**	**variable**	**4**	Bolitho and Overload S12
*Integrated Lecture	Chem 410	**4**	**3**	**4**	Curtis and Cancelled S12
*Integrated Lab	Chem 410L (1 sec)	**0**	**6**	**4**	Curtis and Cancelled S12
Graduate Research Methods	Chem 698	**2 to 6**	**variable**	**4**	Curtis, Meloni
Elective	Chem 386:Special Topic	**4**	**4**	**4**	Margerum S11, Bolitho S12
Misc. Units	(grant release)			**4**	Castro (2)
	Chair		**3 staff**	**5**	Spector, Margerum
	Sabbatical Leave			**16**	Summerhays, Curtis

B. Research

We have five faculty members doing on-campus research and publishing with student authors in analytical/inorganic (Margerum), computational organic (Castro), bio-organic (Bolitho), physical inorganic (Curtis) and physical chemistry (Meloni). One faculty member publishes in philosophy/imagery of chemistry (Spector) and one has interests in process control (Summerhays). Our term and adjunct faculty are not research active. Please refer to the full CVs in the appendix for publication lists.

History of Sponsored Projects by Faculty since 2005: Alphabetical by PI					
Source of support	**Amount**	**Short Title**	**Duration**	**Funded?**	**Faculty**
National Science Foundation	Not provided	Research Infrastructure Stimulus for Renovation of Harney Science Center	2009-	Not Funded	Bolitho, PI Brown (Physics)
Jean Dreyfus Boissevain	$18,500.00	Lectureship/summer research for PUIs	2010	Not Funded	Bolitho
Cottrell College Science Award	$35,000.00	Rational Design, Chemical Synthesis, and Biochemical Evaluation of Small-Molecule Inhibitors of the LuxS Enzyme	2010 and reapply: 2011	Not Funded	Bolitho
National Science Foundation	$268,369.00	Structure and Mechanisms in Annulenes and Polycyclic Aromatic Hydrocarbons	2009–2012	Funded	Castro, Karney
National Science Foundation	$237,400.00	Dynamic Processes in Annulenes	2006–2009	Funded	Castro, Karney
ACS, Petroleum Research Fund	$50,000.00	Dynamic Processes in [4n]Annulenes	2006–2009	Funded	Castro, Karney
National Science Foundation	$363,400.00	RUI: Photoregulation of Phycoerythrin Synthesis in the Cyanobacterium, Fremyella Diplosiphon	2003-2007	Funded	Cobley
Faculty Development Fund	$3,912.00	Regulation of absorption and utilization of light for photosynthesis in the cyanobacterium	2007-2008	Funded	Cobley
Lily Drake Cancer Research Fund	$3,670.00	Development of Novel Antioxidant Assay for Cancer Chemo-Protection Agents	2011	Funded	Curtis
Faculty Development Fund	$7,800.00	Intervalence Charge-Transfer of Mixed-Valence Binuclear Ruthenium Ammine Complexes, Structure of Liquid Water	2011-2010	Funded	Curtis
Faculty Development Fund	$3,608.80	Raman Investigations of Electrolyte Effects on Solvation Environments of Ruthenium, Rhodium and Cobalt Ammine Complexes	Fall 2010	Funded	Curtis
Faculty Development Fund	$3,250.00	Excited-State Lifetimes of Quenching Reactions Between Ru-bpy Derivatives and Ru-NH3 Complexes	Fall 2009	Funded	Curtis
Faculty Development Fund	$3,274.00	Redox State-Dependent Second Coordination Sphere of Ruthenium Ammine by Dissolved Polymers	Spring/ Summer 2009	Funded	Curtis
Faculty Development Fund	$5,620.00	Substituent Effects on Electron-Transfer Self-Exchange Rates of Ruthenium Complexes	Fall-Summer 2008	Funded	Curtis
Faculty Development Fund	$3,400.00	Salt-Specific Studies of Ionic Activity Coefficient Effects on Electrode Potentials	Fall 2007	Funded	Curtis
Faculty Development Fund	$3,900.00	Frontier Orbital Effects on the Rates of Outer-sphere Electron-Transfer Reactions of Ruthenium Complexes	Summer 2007	Funded	Curtis
USF Teaching Effectiveness Fund	$1,250.00	Design of a Digitally-Interfaced Viscometer for Chem 410	Fall 2005	Funded	Curtis

History of Sponsored Projects by Faculty since 2005: Alphabetical by PI					
NSF-RUI	$223,668.00	CHE-Macromolecular/Nano, Immobilized Metal Affinity Reagents on Surface Tethered Dendrimers	F2010-	not F10; resubmit '12	Margerum
Faculty Development Fund (multiple)	$9,000.00	Dendrimer modified controlled pore glass beads for immobilized indicator release assays (IDA)	2010-current	Funded	Margerum
Lily Drake Research Fund	$16,000.00	Immobilized Metal Affinity Reagents on Surface Tethered Dendrimers: Protein Chip Applications	2008-2011	Funded	Margerum
Faculty Development (sum of renewals)	$12,000.00	Metal Complex Binding with Dendrimers	2006-2009	Funded	Margerum
USF Teaching Effectiveness Fund	$1,300.00	LabQuest:Evaluation and Implementation using 5 undergraduate researchers	Summer 2008	Funded	Margerum
Type B ACS-PRF	$50,000.00	Immobilized Dendrimers as Platforms for Multivalent Binding of Metal Ions.	2006	Not Funded	Margerum
Fletcher Jones Foundation	$500,000.00	The Chemistry Studio Laboratory in the new CSI (dean's office+advancement)	submitted 2006	Funded	Margerum
NSF-DUE-CCLI	$135,939.00	Learning through Writing about Environmental Analysis using AAS	2002-2005	Funded	Margerum
ACS-Petroleum Research Fund	$50,000.00	Synchrotron Photoionization Studies of Biofuel Molecules Combustion	2011-/2013	Funded	Meloni
Advanced Light Source (ALS-LBL Beam time	--	Oxidation Reactions of Biofuel Molecules	2011-2012	Funded	Meloni
(ALS) Beam time	--	Biofuel Molecules Oxidation: Reactive Intermediates and Product Identification	2010-2011	Funded	Meloni
Faculty Development Fund (multiple)	$37,000.00	Photoionization Studies at ALS-LBL	2008-2012	Funded	Meloni
(ALS) Beam time	--	Hydroxyl Radical Reactions With Single Molecule Fuels	2009	Funded	Meloni
Faculty Development Fund	$2,765.00	International Society for the Philosophy of Chemistry Summer Symposium	2007	Funded	Spector
NEH Summer Stipend	$10,000.00	Chemistry and Contemporary Visual Art (selected by college to submit)	F2009	not funded	Spector

Summary of Research Activity since 2005

- 48 Peer reviewed publications with 25 different undergraduate student authors
- 19 MS theses completed and filed
- University membership in CUR (Council of Undergraduate Research)
- New USF Celebration of Undergraduate Scholarly Work (all departments), spring 2011-
- Large increase in invited talks to national meetings and other universities
- 2 editorships of peer-review journals (*J. Spectroscopy, Leonardo Journal*)
- Department sponsored student travel awards to national conferences
- Increase in paid student research hours from USF Faculty Development Fund
- Undergraduate Research (Chem 397) required for ACS certified degrees

C. Service

Some highlights were listed in an earlier section and will not be repeated here. A theme for our faculty with on-campus service is a focus on student development (Mentor program, Dean's Medal, curriculum and academic excellence committees, Research celebration, CSI planning) and faculty development (tenure/promotion, faculty development fund, academic computing).

Other ways that the faculty are involved in the profession and community can be found on CVs, but include editorship of journals, peer-reviewing of journal/grant submissions, hosting conferences (International Philosophy of Chemistry, OWL National Faculty Workshop), taking students to regional and national meetings, MS program chairs (no workload release), consultants (Cengage Learning-OWL lead teacher, NovaBay Pharm.) and outreach via the SF Exploratorium or local schools.

V. Departmental Governance

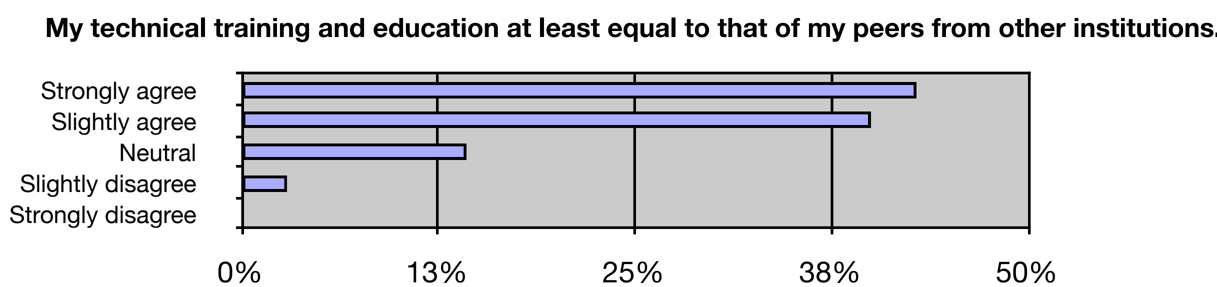
The Department by-laws can be found in the **Appendix** and include a set of objectives that guide our decisions and interactions. The 3-year position as chair is rotated among the tenured faculty by mutual consent. There are monthly meetings with an agenda set by the chair with input from all faculty. Most important decisions on curriculum, student progress and department direction are finalized at these meeting.

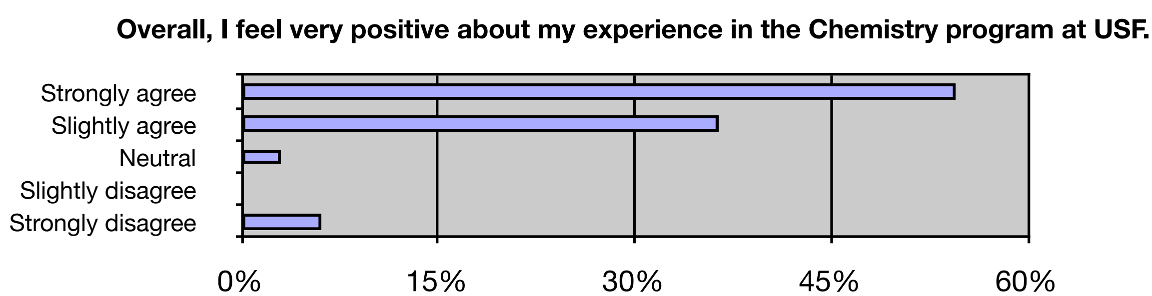
The chair does the vast majority of administration, from daily guidance for the program assistant to stockroom and lab coordinator oversight and review. The department budget is always a source of frustration as the union contract does not allow any input, thus we are given a budget that is always too low on student help (TAs, readers, stockroom help) and has no provision for capital or maintenance. The agreed upon 5 workload units of release time is well deserved for the chair. In addition, the university offers leadership workshops for new chairs. We will have the next chair (F14) attend these and they will also shadow the current chair in their last semester.

VI. Students

Summary of BS Alumni Survey (through *Survey Monkey* of all BS graduates since 2005 using current email address: **Appendix** for full results)

Are we doing a good job of preparing our students? Here is what our graduates self-reported (n=35):





The survey had a 50% response rate, which was outstanding in our minds. Thus, we feel confident about the results and are pleased with the results (except for the 2 students who disagreed about their experience)! To further improve our programs (BS and MS), we are looking for better prepared students than USF has historically recruited, especially in math skills. We are not sure how to make an impact as a department or as individual faculty, but we are always represented at events like, phoning for accepted majors, on-campus programs for accepted students, and orientation events for incoming students in the fall. We seek best practice and advice on how to attract better prepared students into the chemistry major.

We did made changes to our courses and to our major/minor requirements to attract the best current students and to increase the rigor of the undergraduate experience (*Committee on Professional Training, CPT-ACS newsletter, Winter 2011, Vol. 9, No. 1*). Besides personal recruitment from our courses, we reworked General Chemistry labs to incorporate more group work, more inquiry-like experiments, computer-based data collection (LabQuest) and lab practicals, all published methods that encourage a diversity of student success and rigor. We raised the SAT/ACT cut off in General Chemistry to ensure students are prepared for the course. We raised all prerequisites course grades to C or higher, as C- students were not making it. Through our assessment program, we identified a major issue: students do not bring a good working knowledge of prerequisite course material into new courses. We are testing various methods to make students more responsible as the new courses start. We are informing students through syllabi, advising and our webpages. Historically, this issue is most severe in the Physical Chemistry course which has calculus based physics and second semester calculus as prerequisites. Specifically, we seek any advice on how best to address this issue as we debate the merits of adding a separate Physical Chemistry course for Biochemistry concentration majors.

Our department prides itself on our faculty/staff/student interactions and we foster this in many ways. Our SAACS (Student Affiliates to ACS) group is quite active hosting 'meet the faculty' events, hosting a faculty research talk night and participating in student orientations. One faculty member satisfies their service as the advisor. We average 6-10 research students each semester in Chem 397 and in summer. This serves as a way for us to mentor our research students in an informal setting.

VII. Staff

Total FTE = 3.0

<u>Deidre Shymanski:</u> Program Assistant, started 1/2008 (three other PAs since 2004).
Main duties: Office support of faculty, chair and MS program director, coordinate advising/student questions, maintain department web pages, oversee student workers and timecards.

<u>Chad W. Schwietert</u>: Chemistry Laboratory Coordinator and NMR technician, new position, Aug. 2011
Main duties: Organic lab preparation including instrument setup/training, TAs (assignments, scheduling, safety training), NMR quality control and training (1/3 time), other instrument quality control as needed for undergraduate labs.

<u>"Angela" Yishun Qin:</u> Stockroom Manager and Lab Prep, started 2009 (one other SM dismissed, 2007-09).
Main duties: Ordering, cataloging, delivering lab and research chemicals, preparation for general and analytical chemistry labs, centralized waste collection, day to day stockroom management with student workers.

Shared position with all science departments: <u>Andy Huang</u>: Technical Manager (for chemistry: mechanical repairs, NMR fills, gas cylinders, maintenance contracts, hardware upgrades)

At the last review, there were 1.5 FTE staff, plus Andy Huang. Our three current full-time chemistry staff positions officially report to the Associate Dean of Science, Chris Brooks, due to the faculty-union contract. In practice, the department chair has day-to-day oversight and direction, including annual written staff reviews. We were very pleased to hire Chad Schwietert (MS Chemistry from SF-State), who joined us with extensive experience from UC-Davis and Dominican College as a lab coordinator. To be competitive in hiring, we obtained approval for Chad to receive additional payment for running an organic lab section each fall. Angela Qin (MS Chemistry from USF) is our second full time stockroom manager (the first hire in 2007 was let go after 1.5 years due to some issues that cost the chair, Claire Castro, many hours of administrative time).

VIII. Diversity and Internationalization

As shown in the graphs from an earlier section, we have a very diverse set of students in our program, as do most USF departments. The potential implementation of a medicinal chemistry concentration is a direct response to student interest. This was driven by many factors such as the stated interest in this field from many of our majors and minors, plus the experiences of our organic faculty with students (Claire Castro, Tami Spector and Megan Bolitho).

Our goal for students who are interested in study abroad is to find programs with chemistry courses that will transfer to USF, so that students can stay on track for graduation. Frankly, this has not been a high priority in the department as faculty are stretched thin and do not have time to coordinate an international program. We would like examples or advice in this area from other small liberal arts schools. One USF chemistry major went to University College Dublin, Ireland with success. We are in contact with them about USF students taking their chemistry courses. We are debating if and how to promote this to interested chemistry majors.

IX. Technology/ITS support/Library

We have a good and improving support structure on campus from ITS/Technology (four year upgrade program for hardware). Our NMR hardware/software is complex and problematic without a full-time instrument manager, so ITS has helped support this LINEX system. Other maintenance/upgrades to computer based lab equipment does not really happen until something breaks down. With no capital or maintenance budget, the department must go directly to technical operations (Andy Huang) or to the College administration for upgrades. While both have been supportive in the past, this is not the optimal way of doing business. We do not see this changing.

Our Center for Instructional Technology (CIT) on campus has been very helpful for us as we implement new technology (iClickers with Blackboard linked grading, new technology in the classroom and training courses for new or adjunct faculty). The library now provides full-text access to all ACS, RCS and Elsiever journals in place of bound copies on site. We share a SciFinder license with Santa Clara University and the library staff provide training on searching with this interface.

X. Facilities

As outlined above, the new CSI will house undergraduate teaching labs for Organic, Analytical and Inorganic Chemistry. It will not include any faculty office or research space. Harney Science Center was built in 1965 and is near the end of its useful life. Science faculty (Margerum from Chemistry) are on committees to plan renovation of Harney to utilize vacated teaching lab space and to better accommodate modern research. We currently have two research instrument rooms, besides the dedicated NMR room, that serve undergraduate courses and research groups. They are small and crowded with all bench space taken. We strongly support all of these efforts by the University to renovate Harney Science Center.

In late fall 2011, two rooms on the chemistry floor in Harney were reconfigured into three offices and meeting/research space in response to losing one faculty office to CSI construction. We are also in planning mode with faculty and staff on an improvements to the chemistry stockroom and organization of undergraduate labs.

XI. Conclusions to the Self Study Report

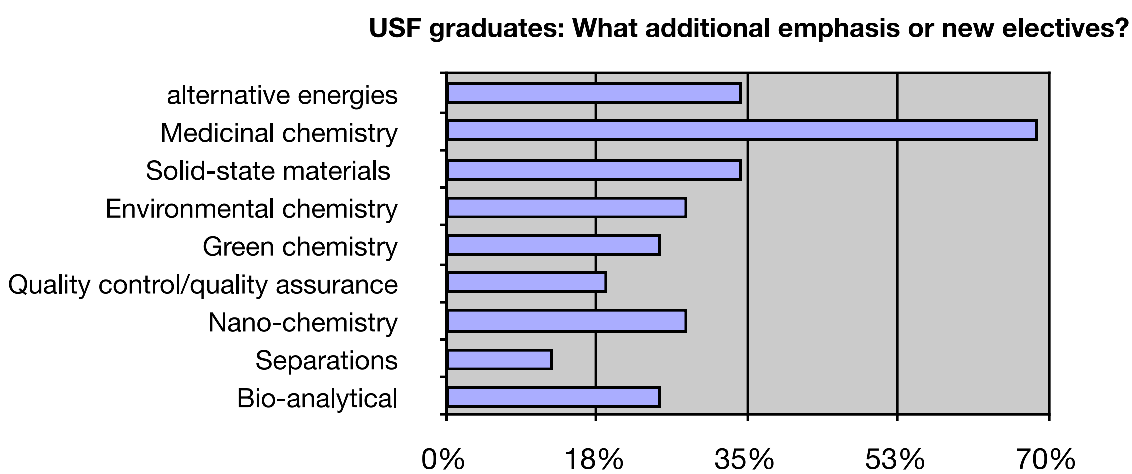
Strengths and improvements since last review

- Faculty desire to see the overall program improve and our students to succeed academically (new mission and assessment program)
- Addition of separate second semester organic labs for majors and minor
- Faculty willing to try new approaches to teaching and assessment. For example, we are discussing moving either analytical chemistry or organic lab for majors to fall of junior year to keep junior majors engaged in lab courses (does not apply to biochemistry concentration)
- New junior faculty contributing right away to curriculum revisions and research with students
- Increased numbers of research grant applications, funding and publications
- Increased staff support and new construction to deliver lab courses; research and teaching; instrument expansion and upgrade
- BS and MS students succeeding in job or graduate school placement
- Small, personalized lab experience using research quality instruments for all majors and MS students

Challenges Identified

- Desire for better prepared undergraduates and master students (math, problem solving skills and course preparation)
- Methods to increase the MS financial package to become more competitive with peer programs and to fairly compensate MS students working as TAs and research assistants
- Ability to offer courses beyond the bare basics, such as a medicinal chemistry concentration (while maintaining our personalized lab experience and small lecture sections)
- Desire to increase the number of Biochemistry concentration majors
- Lack of flexibility in the curriculum: How to meet teaching and student research demand with current faculty at reduced teaching loads or winding down research programs (i.e. pending retirements)
- Expand undergraduate and MS research opportunities in synthetic Organic Chemistry and Biochemistry (short term) and inorganic/materials (long term)

What additional emphasis do our alumni students wish was offered in chemistry now that they are in the working or graduate school world?



XII. Plan for future

The need for a new tenure track position

In the past few years the department has had difficulty in meeting the demands of students who wish to take chemistry courses at the lower division (General and Organic Chemistry). As USF prides itself on low student: faculty ratio, the department resists increasing lecture size, especially after securing more lecture sections in General (initial limit of 45) and Organic Chemistry (initial limit of 40) during the 2002 curriculum change to 4 unit classes. For the last two years our four sections of General Chemistry in the fall have 60-65 students and Organic sections are close to 50. In addition, the first semester Organic Chem 232 Lab, increased from four sections to six and then to eight sections by fall 2011. Yet, increasing lab size and sections is problematic due to physical and staffing limitations. In particular, with the rise of student interest for health-related fields (PharmD, Dental, Medicine) the desire for a two-semester organic lab sequence has also increased. Before 2004, we offered one section of second semester Organic lab filled by majors and those few biology majors who felt compelled to take it. Starting in spring 2004 we began to offer one section of Chem 234 Lab, a second semester course for Biology majors [note: the Biology major does NOT require a year long Organic Chemistry lab]. We now need two sections of this lab, which filled for spring (S2012) with a waiting list. The majors' only lab, Chem 233, also filled (and has a waiting list). Coupled with this growth has been the move of a formerly full time organic faculty member to a reduced workload (Claire Castro). The Department's experience has been that organic labs run more smoothly and safely when faculty (versus adjuncts or TAs) are present and in charge. *We choose to use faculty workload to deliver multi-sections of lab, leaving some lecture sections to be covered by adjuncts.* While we outline the difficulties faced in delivering the organic curriculum, similar issues exist in delivering the General Chemistry curriculum (Jeff Curtis is also at reduced teaching load).

Our two most recent hires (physical/biofuels and bio-organic) reflect the modern trend of scientists working in an area where the borders between traditional chemistry disciplines are blurred. Of particular interest to us is developing a pre-pharmaceutical or medicinal concentration within our program. Our survey show it is the single most requested emphasis by alumni and current students. To accomplish this we envision hiring an additional tenure track faculty who would be able to teach organic chemistry, but would also have an expertise in the area of medicinal chemistry/biochemistry. Such a new position would provide an opportunity to expand the research areas of our department at both the MS and BS level. In addition, this faculty member would be instrumental in helping build a new concentration that would better serve those students who wish to apply to Pharmacy schools. We hope that this person could strengthen ties to local biotechnology or pharmaceutical companies. Such a new hire would also complement the interests of Assistant Professor Megan Bolitho, whose training is in chemical biology and whose research interest spans synthetic Organic Chemistry and Biochemistry.

Future Planning

The department anticipates the retirement of one or two faculty in the next 3-5 years. This opens the possibility for the department to build on its efforts to promote interdisciplinary courses within the chemistry curriculum.

Objective and priorities

- Hire a new tenure track position with interdisciplinary research interests and ability to teach in the Organic chemistry curriuclum
- Increase the financial package for MS graduate students
- Develop a new concentration for majors in medicinal chemistry (this is a tentative name), building on our strengths in bio-organic, organic and computational organic
- Explore adding a one-semester Foundations of Physical Chemistry to better serve our biochemistry concentration majors (or new concentrations)
- Develop best practices and methods for our assessment programs, especially on new learning outcomes that are aimed to improve the program
- Plan to replace retiring faculty with assistant professors having interdisciplinary research interests and ability to teach in several sub-disciplines (potentially physical, inorganic, biochemistry)

XIII. Appendices

A. Survey of alumni

USF BS Chemistry Alumni Survey		
Q1. I completed (or will complete) my USF degree with a		
Answer Options:	Response Percentage	Response Count
BS Chemistry	37.1%	13
BS Chemistry-ACS certified	25.7%	9
BS Chemistry with Biochemistry Concentration	28.6%	10
BS Chemistry with Biochemistry Concentration-ACS certified	8.6%	3
	answered question	35
	skipped question	0
Q2. What have you done since leaving USF? Check all items that apply to you:		
Answer Options:		Response Count
Graduate School in Chemistry, Biochemistry or Science related field		18
Medical School		4
Pharmacy or other health related graduate school		4
Position in a chemistry/biochemistry related industry		13
Position in other industry		7
K-12 Teaching		1
Community College or University teaching		0
Work in non-profit company		0
Other (please specify):		3
1. I work at UCSF Inpatient Pharmacy as a pharmacy technician. (Alumni response)		
2. Pharmaceuticals - Clinical Operations (Alumni response)		
3. Basic Science research at UCSF (Alumni response)		
	answered question	35
	skipped question	0
Q3. I feel my technical training and education at USF were at least equal to that of my peers who graduated from other institutions.		
Answer Options:	Response Percent	Response Count
Strongly agree	42.9%	15
Slightly agree	40.0%	14
Neutral	14.3%	5
Slightly disagree	2.9%	1
Strongly disagree	0.0%	0
	answered question	35
	skipped question	0
The American Chemical Society has identified a set of skills needed to become successful science professionals: These skills, which can also be termed process skills, soft skills, or employability skills, share the characteristics that they are generic and transferable, are marketable and lifelong, and have wide applications that go beyond course content alone (this and the skills cited below are from ACS publication CNBP_025490). Please read the descriptions and rank each skill with regard to your USF Chemistry experience from coursework, labs, research or informal interactions with the faculty and staff in the department (if you were a TA at USF, include this training/experience also).		

Q4. Problem-Solving Skills Students should be able to apply the scientific method: define a problem clearly, develop testable hypotheses, design and execute experiments, analyze data, and draw appropriate conclusions. Examinations should be constructed to encourage the synthesis of a variety of concepts in solving problems while discouraging rote memorization. Students should be able to integrate knowledge across chemical sub-disciplines and apply this knowledge to solve problems. In the laboratory, they should understand the use of statistical methods and the fundamental uncertainties in experimental measurements.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	24.2%	8
Good development	42.4%	14
Very high development	33.3%	11
	answered question	33
	skipped question	2

Q5. Communication Skills Students should have a variety of writing experiences, not limited to laboratory reports. They should be able to synthesize information from a variety of sources in a clear and organized manner using a scientifically appropriate style (written and oral). Students should be able to use technology such as presentation software, word processing/graphics, spreadsheets, and chemical-structure drawing in written, oral or poster formats.		
Answer Options:	Response Percent	Response Count
Little or no development	6.3%	2
Adequate development	28.1%	9
Good development	25.0%	8
Very high development	40.6%	13
	answered question	32
	skipped question	3

Q6. Chemical Literature Skills Students should be able to retrieve specific information from the chemical literature, evaluate technical articles critically and use the peer-reviewed scientific literature effectively. They should be comfortable in using SciFinder/Chemical Abstracts and other compilations.		
Answer Options:	Response Percent	Response Count
Little or no development	3.0%	1
Adequate development	27.3%	9
Good development	51.5%	17
Very high development	18.2%	6
	answered question	33
	skipped question	2

Q7. Laboratory Safety Skills A high degree of safety awareness should begin with the first laboratory course and includes understanding safety and dress rules; knowing when to use fume hoods; the use of safety/emergency equipment; handling, storage, and disposal of chemical waste; understanding and use of material safety data sheets; awareness of OSHA requirements; and, in general, knowing how to handle laboratory emergencies effectively.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	18.2%	6
Good development	24.2%	8
Very high development	57.6%	19
	answered question	33
	skipped question	2

Q8. Team Skills Solving scientific problems often involves working in teams. Students should learn to work productively with a diverse group of peers; and should be able to lead portions of an activity or be effective followers, as dictated by the situation.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	9.1%	3
Good development	42.4%	14
Very high development	48.5%	16
	answered question	33
	skipped question	2

Q9. Ethics Progress in chemistry, as in all sciences, relies on complete honesty, openness, and trustworthiness of chemists, and on reproducibility of experimental results. Students should display high personal standards and integrity, conduct themselves responsibly, and be aware of contemporary issues related to chemistry.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	12.1%	4
Good development	51.5%	17
Very high development	36.4%	12
	answered question	33
	skipped question	2
Q10. Looking back on your USF experience, what additional emphasis or new electives do you think should be part of a Chemistry curriculum (choose three or fewer)?		
Answer Options:	Response Percent	Response Count
Solar and alternative energies	34.4%	11
Medicinal or pharmaceutical chemistry	68.8%	22
Solid-state materials (semiconductors, crystal structures, etc....)	34.4%	11
Environmental chemistry	28.1%	9
Green chemistry	25.0%	8
Quality control/quality assurance	18.8%	6
Nano-chemistry	28.1%	9
Separations	12.5%	4
Bio-analytical	25.0%	8
	answered question	32
	skipped question	3
Q11. Overall, I feel very positive about my experience in the Chemistry program at USF.		
Answer Options:	Response Percent	Response Count
Strongly agree	54.5%	18
Slightly agree	36.4%	12
Neutral	3.0%	1
Slightly disagree	0.0%	0
Strongly disagree	6.1%	2
	answered question	33
	skipped question	2

USF MS Chemistry Alumni Survey		
Q1. What have you done since leaving USF? Check all items that apply to you:		
Answer Options:		Response Count
Graduate School in Chemistry, Biochemistry or Science related field		7
Medical School		0
Pharmacy or other health related graduate school		0
Position in a chemistry/biochemistry related industry		4
Position in other industry		0
K-12 Teaching		0
Community College or University teaching		2
Work in non-profit company		0
Other (please specify):		1
1. MBA, biotech then government/public policy in clean energy (Alumni response)		
	answered question	10
	skipped question	1
Q2. I feel my technical training and education at USF were at least equal to that of my peers who graduated from other institutions.		
Answer Options:	Response Percent	Response Count
Strongly agree	81.8%	9
Slightly agree	18.2%	2
Neutral	0.0%	0
Slightly disagree	0.0%	0
Strongly disagree	0.0%	0
	answered question	11
	skipped question	0
The American Chemical Society has identified a set of skills needed to become successful science professionals: These skills, which can also be termed process skills, soft skills, or employability skills, share the characteristics that they are generic and transferable, are marketable and lifelong, and have wide applications that go beyond course content alone (this and the skills cited below are from ACS publication CNBP_025490). Please read the descriptions and rank each skill with regard to your USF Chemistry experience from coursework, labs, research or informal interactions with the faculty and staff in the department (if you were a TA at USF, include this training/experience also).		
Q3. Problem-Solving Skills Students should be able to apply the scientific method: define a problem clearly, develop testable hypotheses, design and execute experiments, analyze data, and draw appropriate conclusions. Examinations should be constructed to encourage the synthesis of a variety of concepts in solving problems while discouraging rote memorization. Students should be able to integrate knowledge across chemical sub-disciplines and apply this knowledge to solve problems. In the laboratory, they should understand the use of statistical methods and the fundamental uncertainties in experimental measurements.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	0.0%	0
Good development	70.0%	7
Very high development	30.0%	3
	answered question	10
	skipped question	1
Q4. Communication Skills Students should have a variety of writing experiences, not limited to laboratory reports. They should be able to synthesize information from a variety of sources in a clear and organized manner using a scientifically appropriate style (written and oral). Students should be able to use technology such as presentation software, word processing/graphics, spreadsheets, and chemical-structure drawing in written, oral or poster formats.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0

Adequate development	10.0%	1
Good development	40.0%	4
Very high development	50.0%	5
	answered question	10
	skipped question	1
Q5. Chemical Literature Skills Students should be able to retrieve specific information from the chemical literature, evaluate technical articles critically and use the peer-reviewed scientific literature effectively. They should be comfortable in using SciFinder/Chemical Abstracts and other compilations.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	0.0%	0
Good development	40.0%	4
Very high development	60.0%	6
	answered question	10
	skipped question	1
Q6. Laboratory Safety Skills A high degree of safety awareness should begin with the first laboratory course and includes understanding safety and dress rules; knowing when to use fume hoods; the use of safety/emergency equipment; handling, storage, and disposal of chemical waste; understanding and use of material safety data sheets; awareness of OSHA requirements; and, in general, knowing how to handle laboratory emergencies effectively.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	10.0%	1
Good development	40.0%	4
Very high development	50.0%	5
	answered question	10
	skipped question	1
Q7. Team Skills Solving scientific problems often involves working in teams. Students should learn to work productively with a diverse group of peers; and should be able to lead portions of an activity or be effective followers, as dictated by the situation.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	0.0%	0
Good development	50.0%	5
Very high development	50.0%	5
	answered question	10
	skipped question	1
Q8. Ethics Progress in chemistry, as in all sciences, relies on complete honesty, openness, and trustworthiness of chemists, and on reproducibility of experimental results. Students should display high personal standards and integrity, conduct themselves responsibly, and be aware of contemporary issues related to chemistry.		
Answer Options:	Response Percent	Response Count
Little or no development	0.0%	0
Adequate development	20.0%	2
Good development	20.0%	2
Very high development	60.0%	6
	answered question	10
	skipped question	1
Q9. Looking back on your USF experience, what additional emphasis or new electives do you think should be part of a Chemistry curriculum (choose three or fewer)?		
Answer Options:	Response Percent	Response Count
Solar and alternative energies	30.0%	3
Medicinal or pharmaceutical chemistry	50.0%	5

Solid-state materials (semiconductors, crystal structures, etc....)	20.0%	2
Environmental chemistry	30.0%	3
Green chemistry	10.0%	1
Quality control/quality assurance	20.0%	2
Nano-chemistry	20.0%	2
Separations	10.0%	1
Bio-analytical	0.0%	0
	answered question	10
	skipped question	1
Q10. Overall, I feel very positive about my experience in the Chemistry program at USF.		
Answer Options:	Response Percent	Response Count
Strongly agree	90.0%	9
Slightly agree	10.0%	1
Neutral	0.0%	0
Slightly disagree	0.0%	0
Strongly disagree	0.0%	0
	answered question	10
	skipped question	1
Q11. While pursuing my MS degree, concerns about finances interfered with my ability to concentrate on my studies/research.		
Answer Options:	Response Percent	Response Count
Strongly agree	10.0%	1
Slightly agree	20.0%	2
Neutral	30.0%	3
Slightly disagree	30.0%	3
Strongly disagree	10.0%	1
	answered question	10
	skipped question	1
Q12. As an MS research student or TA, I made a positive impact in mentoring USF undergraduates in science research or courses.		
Answer Options:	Response Percent	Response Count
Strongly agree	90.0%	9
Slightly agree	10.0%	1
Neutral	0.0%	0
Slightly disagree	0.0%	0
Strongly disagree	0.0%	0
	answered question	10
	skipped question	1
Q13. The MS degree was helpful in getting me a job or placement into graduate school.		
Answer Options:	Response Percent	Response Count
Strongly agree	90.0%	9
Slightly agree	10.0%	1
Neutral	0.0%	0
Slightly disagree	0.0%	0
Strongly disagree	0.0%	0
	answered question	10
	skipped question	1

B.

C. Summary of support in other MS programs

In the **Table below,** we summarize facts and figures regarding some comparator programs and student support data collected in 2010-11 by way of phone interviews with the Graduate Directors of a number of small to midsized schools. The comparator set represents schools of varying quality or reputation (please note the absence of any "first-tier" or "exclusive" schools here; we were shooting for at plausible comparisons)

Table: Comparison of TA/RA pay at primarily MS Chemistry departments

School	# Full-Time Faculty and accept MS students	BS Majors	MS Majors	Ph.D	Tuition Waived? / Tuition per year	TA / RA Stipend	TA contact hours weekly / total paid hrs/wk
Marshall University	14 and 10	200-225	5	none	Yes/$9,950	$12,000/ 12 mos.	6 contact hrs./ 8-10 hrs. weekly
University of Minnesota, Duluth	20 and 19	386	28	none	Yes/$12,360.	$14,600/9 mos.	9 hrs./ 20 hrs.
Villanova University	22 and 12	66	15	none	Yes/$10,500.	$16,000/ 9 mos.	20 hrs. total
Northern Arizona University	20 and 13	360	15	none	No/$2,522	$12,390/9 mos.	20 hrs. total
University of Scranton	10 and 10	30	5	none	Varies/ $12,195	$8,800	Not given
Central Michigan University	18 and 11	42	17	none	Yes/$10,500	$10,800	7-8 contact hrs
San Francisco State University	19 and 15	500	<40	none	No/$6,802	$18,000	20 hrs. total
University of Pacific, Stockton, CA	11 and 11	30	4	17	Yes/ $33,600	$19,984/9 mos.	6 hrs./20 hrs. total
St. Louis University	14 and 10	120	9	20	Yes/$16,722	$24,000/12 mos.	14 hrs. total
East Carolina University	19 and 12	100-125	16	5	No/$6,000	$13,500/per year	20 hrs. total
Marquette University	14 and 10	55	4	39	yes	$20,161/10 mos.	20 hrs. total
University of San Francisco	9 and 4	80	13	none	Yes/$11,580	$7,200/8 mos.	8 contact hours/20 hrs. total

Information collected from interviews and university websites.

USF does not pay graduate students a stipend. In column "**TA / TA Stipend**" for USF the $7200/8 months comes from timecards: (20 hrs/week x $12/hr x 30 semester weeks =$7200). For other schools the average is $30.68/hr (stipend / total semester hours). *Our payment of $7200/less than one-half of the $20,172/year average at comparable institutions.*

We seek ways to improve the quality of our graduate program. We have not keep up in our financial package. The predictable result is that we are generally forced to recruit from our applicant pool for whom cost is no object, or must admit applicants who have trouble gaining admittance anywhere else. As a consequence our applicant pool, while competitive, is at a low academic achievement level. This has consequences when these students become TAs. Some of the intellectual and maturity levels we meet with (besides poor English skills for ESL students) lead to undergraduate student complaints in trying to deliver a lab course. The ever-present financial stress on (some of) these students often spills over into full-blown desperation (working off-campus illegally, diluting their time and energy for academic work). There is a temptation for these students to take jobs or start PhD programs before they are finished.

A secondary effect of the under-support is in column two of the **Table**; only 4 of the 9 full time faculty at USF currently accept Master's students. While we are committed by consensus to *never* require participation in the Master's program, a participation rate > 40% would be of great benefit and would enhance academic vitality in the department (our model research "groups" with both Master's and undergrads does indeed work quite well). Dealing with students who are in many cases recruited from the bottom of the applicant pool makes participation rather daunting to faculty because of the time and energy drain that comes from pulling the weaker ones through to completion. Non participating faculty cite this issue and the lack of recognition for taking graduate students as significant barriers. Even for professor taking graduate students, these issue affect productivity and sometimes makes it hard for faculty to reliably attract larger project grant funds (such as NSF and NIH).

We have not had success convincing the administration that increasing TA support levels will help get better students, will increase productity of existing students (no outside jobs to survive), will lower the barriers to faculty participation and increase indirect grant monies. One clear mechanism would be to move away from TA's paid out of the general "student help" budgets (hourly wage) and move to the "stipend" model as everyone else does (see **Table One**). This would also allow for directed fund raising activities (discussions with University Advancement) as alumni and corporations are more inclined to donate to benefit students. Given the ubiquity of the stipend format everywhere else, we find it frustrating that the University resists any change from an hourly wage format.

D. BS/MS Assessment reports (samples)

(Formal third year assessment report was not required. This is an internal document)

July 2011 Person completing the Report: Professor Larry Margerum

1. **Overview Statement**: Briefly summarize the assessment activities that were undertaken this academic year, indicating:

   a. **which program learning outcomes were assessed this year: all**
   b. **who in your department/program was involved in the assessment:**

Jeff Curtis, Larry Margerum, Tami Spector, Claire Castro, Megan Bolitho, Giovanni Meloni, Kim Summerhays
Summary: Our methods of assessment ranged from using standardized American Chemical Society subject exams, embedded questions in exams, class grades/rubrics on specific assignments, clicker questions in-class, overall class grades, and student presentations at scientific meetings. The courses involved in the program assessment included both upper division and lower division classes, as well as lecture-only and lecture-lab courses.

2. **Please Answers the Following Questions for Each of the Student Outcomes Assessed:**
   a. **<u>What did you do?</u>** Describe clearly and concisely how you assessed the learning outcomes that were evaluated this year (e.g., measures, research methods, etc.).

• **Outcome 1a/b:** *Identify and articulate foundational chemical principles of each sub-discipline in our curriculum*

1. A standardized, subject specific American Chemical Society (ACS): General Chemistry (Chem 113), Analytical Chemistry (Chem 260) and Inorganic Chemistry (Chem 420). National average as our benchmark
2. Embedded questions on the final exams for Organic Chemistry (Chem 230). These questions dealt specifically with abilities to: "predict the product" of a reaction; to develop a mechanism using curved arrow formalism; to interpret simple NMR spectra (Table 2).
3. Chem 350/351 Biochemistry. A set of ten multiple-choice questions covering foundational principles of biochemistry were embedded into the final exam for Chem 350 in fall 2010. First, each student's score on these questions was used to assess their understanding of foundational biochemical principals. Second, this same set of ten questions was again asked of the 11 continuing students in Chem 351 at the start of the spring 2011 semester. Scores for each individual student and the class as a whole were compared across Chem 350 and Chem 351 to measure the retention of foundational information from one course into its continuation course.

• **Outcome 2:** *Solve typical theoretical and experimental problems in chemistry*

1. Analysis of chemistry major scores in the final exams for Organic Chemistry II (Chem 231). Interpreting

spectroscopy, developing a synthesis of a molecule, and mechanism for a reaction.

2. ***Overall evaluation (course grades) of the 14 chemistry majors in first semester Physical Chemistry (Chem 340).

• **Outcome 3:** *Acquire and analyze data using experimental, computational and instrumental methods*

1. Chem 233 Organic Lab for majors: A lab practical exam was administered that involved the synthesis of a known compound (bupropion), its isolation as the hydrochloride salt, and a variety of analytical tasks.
2. ***Overall evaluation of 12 chemistry majors in Inorganic Chemistry (Chem 420), based on the assessment rubric for this outcome.

• **Outcome 4:** *Perform and plan chemical experiments, including running basic synthetic reactions and employing isolation and purification techniques*

1. Chem 233 Organic Lab for majors: A lab practical exam was administered that involved the synthesis of a known compound (bupropion), its isolation as the hydrochloride salt, and a variety of analytical tasks.
2. ***Overall evaluation of 12 chemistry majors in Inorganic Chemistry (Chem 420), based on the assessment rubric for this outcome;
3. ***Overall evaluation, 6 majors in Integrated (Chem 410), based on the assessment rubric for this outcome.

• **Outcome 5:** *Find, organize and present valid scientific information in written and oral form assisted by the use of computer technology*

1. ***Overall evaluation of 12 chemistry majors in Inorganic Chemistry (Chem 420), based on the assessment rubric for this outcome;
2. ***Overall evaluation of 6 chemistry majors in Integrated Laboratory (Chem 410), based on the assessment rubric for this outcome;
3. Overall evaluation 5 chemistry majors in Research Methods and Practice (Chem 397) who presented research posters at an American Chemical Society (ACS) meeting or local Research Celebration day.

• **Outcome 6:** *Successfully pursue post-BS opportunities related to chemistry (on-going)*

1. ***Graduating students self-reported their plans via Chem 397 (see Survey of BS Alumni)

b. What did the faculty in the department or program learn this year?

1. **Outcome 1:** *Identify and articulate foundational chemical principles of each sub-discipline*

Table 1 by course, by year and by graduating class (longitudinal). Not all sections assessed every semester. All students in the course were assessed (<10% are majors in Chem 113).

USF Chem 113 Assessment: Full year ACS exam for General (2007 Form)	National Averages	Spring 2008 Class of ’11	Spring 2009 (n=78) Class of ’12	Spring 2010 section 03 (n=47) Class of ’13	Spring 2011 section 01 (n=41) Class of ’14	Spring 2011 Section 02 (n=51)	Spring 2011 Section 03 (n=68)	Spring 2012 section 01 (n=) Class of ’15
Average [70 MC]	**39.4**		**35.4**	**36.5**	**34.2**	**36.1**	**32.5**	
standard deviation	11.6		9.5	8.7	9.2	9.8	10.3	
Median score	38.8			37.5	33.0	36.0	30.0	
High score			59.0	61.0	55.0	55.0	61.0	
Low score			15.0	24.0	18.0	15.0	18.0	
% below national								
USF Chem 260 ACS exam for Analytical (2007 Form)	**National Averages : (n=707)**		**Spring 2010 (n=9 majors only) Class of ’12**	**Spring 2011 (n=24, all) Class of ’13**	**Spring 2012 (n=24, all) Class of ’14**			
Average [50 MC]	**27.5**		**26.4**	**24.7**				
standard deviation	7.1		7.3	6.1				
Median score	26.7			24.0				
High score			36	35.0				
Low score			17	14.0				
% below national			55.00%	58.00%				
USF Chem 420 ACS Exam (2002 Form)	**National Averages**	**Fall 2010 (n=9 majors) Class of ’11**	**Fall 2011 (n=) Class of ’12**	**Fall 2012 (n=) Class of ’13**	**Fall 2013 (n=) Class of ’14**			
Average score [60 MC]	**28.38**	**35.8**						
standard deviation	8.10	11.2						
Median score	28.1	33						
High score		58						
Low score		24						
% below national		28.60%						

S 11 Question#	Chem 113 LOWEST SCORES <35% correct or (< 25%)	content
4	identify longest emission wavelength	Chem 111
7 (< 25%)	electron config of Pb(II)	both?
11	id smallest bond angle from formula	Chem 111
16	empirical formula from mass CHO	Chem 111
20	%yield of reaction	Chem 111
29	Calc new P from new T (in oC) given moles/constant V	Chem 111
32	Vol. needed to get 0.5 mol X from 1.92 M MX2	Chem 111
33	concept freezing point/vapor P of salt water	Chem 111
44	concept equilibrium constant given diagrams vs. time	Chem 113
47	pick pKa from titration curve	Chem 113

S 11 Question#	Chem 113 LOWEST SCORES <35% correct or (< 25%)	content
48	pH water at 60oC given Kw	Chem 113
49	pH of salt solution (KBr)	Chem 113
50	identify buffer	Chem 113
51	calc pH of buffer given acid/base/Ka	Chem 113
56	calc Eox from Ered (2 moles)	Chem 113
58	id anode reaction in water electrolysis	Chem 113
63	id oxidation number in coordination complex	Chem 113
68	pick glassware for 25.00 mL	Lab
69	given data pick precision/accuracy	Lab

Table 2: Results for embedded questions in Organic Chemistry I final exam (Chem 230); n=4.

Chem 350/351: Ten question quiz repeated in following course:

	Excellent (10-9)	Good (8-7)	Fair (6-5)	Poor (4-3)	Fail (2-0)
All Chem 350 (n = 25, Ave 7.8)	8	13	4	0	0
Chem 351 continuing (n = 11, Ave 8.2)	4	7	0	0	0

Almost all Chem 350 students (88%) scored approximately as well or better on this set of questions than they scored on the final exam as a whole (class average on final exam: 75%). Of the 4 lowest-performing students (score of 6), three earned course grades of C- or below, precluding them from advancing to Chem 351. Of the 8 highest-performing students (scores of 9 or 10), half (4) enrolled in Chem 351 for the ensuing semester.

Upon re-assessment of these same questions for the 11 continuing students, the class average (out of 10 points) was 7.6 (good). Four students (36%) performed as well or better on this second round of questioning (Chem 351) than in the first (Chem 350 final).

Conclusions for Outcome 1:

i. **General Chemistry**: Our average student scores are within one standard deviation from the national mean (range 32.6-36.4 correct out of 70 over the last three years). This year we identified the questions with the lowest scores for possible further action.

ii. **Analytical Chemistry**: The results over the last two years indicate that our students compare well with the national mean. We find 55-58% of students are below the benchmark, although some of these students are not majors.

2. **Outcome 2**: *Solve typical theoretical and experimental problems in chemistry*

Lower Division

Table 4: Results for embedded questions in Organic Chemistry II final exam (Chem 231); n=6.

Type of Problem	Possible points	Avg. score	High score	Low score
aromaticity	9	5.7	9	3
spectroscopy	12	9	11	6
mechanism	9	4.6	9	2
multi-step synthesis	14	7.3	14	0

These results translate into the following assessment:

17% good to very good, 33% average, 50% poor

Upper Division: Overall rubric performance of 14 students in Chem 340 (Physical Chemistry I):

36% good to very good;
64% average;
0% poor

Conclusions for Outcome 2:

i. Organic Chemistry II: We are unable to draw any firm conclusions, based on the small number of chemistry majors in this class. Clearly there is a range of student ability, with the number of students performing poorly being more populous than the number of students performing very well. However, like Organic Chemistry I, Organic

Chemistry II is a large course that serves students interested in pre-professional health programs as well as chemistry majors. Thus, in the future, we will use data from all enrolled students to get a clearer picture of how our learning outcomes are being met by the student population.

ii. **Physical Chemistry I**: All students met the benchmark standard for this outcome, which is an improvement from last year's assessment (11% poor). However, relative to 2009, the %good to very good decreased (36% vs 55%), while %average increased (64% vs 33%). This may be due to the small data set, and different faculty teaching the course, rather than a significant change in students' abilities to meet the outcomes.

3. Outcome 3: *Acquire and analyze data using experimental, computational and instrumental methods*
Using a variety of activities/assignments in Chemistry 420 lab (Inorganic lab), the following overall assessment was obtained (n=12):

67% good to very good;
33% average
0% poor

Conclusions for Outcome 3:
Inorganic Chemistry: All students were found competent regarding this outcome. This reflects an improvement from the previous year, in which 31% (4 students) performed below the benchmark. This change may be due simply to variation in student body as the curriculum from the previous year was not changed significantly.

4. **Outcome 4**: *Perform and plan chemical experiments, including running basic synthetic reactions and employing isolation and purification techniques*
A. Using a variety of activities/assignments in Chemistry 420 lab (Inorganic lab), the following overall assessment was obtained (n=12):

67% good to very good;
33% average
0% poor

B. Using a variety of activities/assignments Chemistry 410 (Integrated lab), the following overall assessment was obtained, n=6:

50% very good;
50% good

Conclusions:
i. **Inorganic Chemistry**: All students were found competent regarding this outcome. As mentioned above, the improvement shown regarding performance in this outcome as compared to the previous year is possibly due to the variability in student performance from year to year.

ii. **Integrated Lab:** As this was the first time this course was assessed, it is difficult to draw a conclusion, however we note that all students were found to meet our benchmark standard.

5.**Outcome 5**: *Find, organize and present valid scientific information in written and oral form assisted by the use of computer technology*
A. Using a variety of activities/assignments in Chemistry 420 lab (Inorganic lab), the following overall assessment was obtained (n=12):

67% good to very good;
33%% average
0% poor

B. Using a variety of activities/assignments Chemistry 410 (Integrated lab), the following overall assessment was obtained, n=6:

100% good to very good

C. Final poster and oral presentations for 9 students in Chem 397 (Research Methods and Practice):

33% very good;
67% good
0% poor

Conclusion:

Student performance in all three of these courses reflect that all of our majors met the benchmark for this outcome–all were able to find and articulate scientific information, whether as a student report, a mini-class presentation, or a formal presentation at a scientific meeting in a coherent fashion.

6. **Outcome 6:** Successfully pursue post-BS opportunities related to chemistry (on-going)

Conclusion:

Student performance in all three of these courses reflect that all of our majors met the benchmark for this outcome–all were able to find and articulate scientific information, whether as a student report, a mini-class presentation, or a formal presentation at a scientific meeting in a coherent fashion.

c. **<u>What will be done differently as a result of what was learned this year</u>?**
Discuss how courses and/or curricula will be changed to improve student learning as a result of the assessment. Include a discussion of how the faculty will help students overcome their weaknesses and improve their strengths.

In general, we seem to be doing well in major courses with a lab component. Although, experiments often undergo revision, and lecture styles change, the data does not indicate that a significant change in the curriculum needs to occur as of this writing. More difficult to assess are the introductory courses (General Chemistry and Organic Chemistry) that serve as gateways to the major. While the results of the ACS standardized exam in General Chemistry suggests that the USF student average is slightly below the national average, this may be due to the USF population (with poorer math skills) rather than be due to a curricular issue. This Fall (2010) the Department will discuss the possibility of increasing the math requirement for General Chemistry I. It is also difficult to determine the strengths/weaknesses of the curriculum when we have such few chemistry majors–variations in student abilities from year to year can skew the statistics, rendering them meaningless. To address this, we will try and assess the entire class for the lower division courses, instead of just the majors.

d. **<u>What actions were taken this academic year "to close the loop" relative to what was discovered from last years assessment activities?</u>**
Discuss how courses and/or curricula changed to improve student learning as a result of last year's assessment. Include a discussion of how the faculty helped students overcome their weaknesses and improve their strengths.

***For fall 2010 we increased the General Chemistry 111 entrance requirement to a minimum score of Math SAT 530 or Math ACT 23 OR USF math placement 20, with the goal of setting higher expectations for problem-solving in the course and reducing the number of poorly performing students. Based on the ACS exam score we did not see a large difference although we had an increase in enrollment for Chem 111 from 200 up to 260 in fall '10.

MS PROGRAM ASSESSMENT REPORT AY 2009-2010

Report Date:	**8/1/2010 (data collected for 2011.no formal report)**
School/College:	Arts and Sciences
Department/Program:	Chemistry/MS degree
Person completing the Report:	Larry Margerum

1. **Overview Statement**: Briefly summarize the assessment activities that were undertaken this academic year, indicating:
   a. Which program learning outcomes were assessed this year?
      i. **1a.** Students will demonstrate knowledge on American Chemical Society (ACS) subject exams and/or selected final exam questions**.**
      ii. **1b**. Students will organize and summarize relevant resources in the chemical literature pertaining to their research area via progress reports and/or a research thesis
      iii. **3a**. Students will exhibit and employ good communication and teaching practice as assistants in undergraduate laboratories
      iv. **3b**. Students will exhibit the ability to prepare professional reports and/or multi-media presentations in formal (seminars, courses, professional meetings) and informal (group meetings) settings.
      v. **2a.** Students can safely operate and analyze results from research quality instruments for their project.
      vi. **5ab:** Formulate and execute a plan to secure position after MS degree

   b. Whom in your department/program was involved in the assessment of the above learning outcomes
      Professors Margerum, Curtis, Meloni and Bolitho

2. **Please Answers the Following Questions for Each of the Student Outcomes Assessed:**

a. <u>What did you do?</u>

Describe clearly and concisely how you assessed the learning outcomes that were evaluated this year (e.g., measures, research methods, etc.). [Please use bullet points to answer this question]

- **1a:** Compare results of ACS exams to national norms (60th percentile benchmark).
- **1b:** Embedded in a written research report by MS students and graded by two faculty members using rubric (for first year students only)
- **3a:** Survey of general chemistry lab students (TA evaluation)
- **3b**: Written progress reports for MS students as part of Chem 698 (Research Methods/Practice). Assessment by rubric by at least one faculty member.
- **2a**: embedded in attachments to research progress reports. Informal assessment from research director and department instrument manager.

b. <u>What did the faculty in the department or program learn</u>?

Summarize your findings and conclusions as a result of the assessment indicating strengths and weaknesses in student learning demonstrated by this assessment.

The second year of assessment was for a cohort of 7 MS students who started the program in 2009 (Spring and Fall semesters). Two others started in Fall 2008 ('second year students').

1a: Demonstrate Knowledge: Students come to the MS program from very diverse backgrounds that may not match the content on ACS exams (for example, almost none of our Pacific Rim students pass the Inorganic ACS exam as these students do not normally take a senior-level course in this area, while US students do). By policy, deficiencies are corrected by taking coursework or retaking an ACS exam after 1 semester.

(Incoming preparation) ACS exams:	2 or 3 exams each x 7 students
Very Good preparation (> 60^{th} percentile)	2/16
Average preparation (50^{th}-60^{th} percentile)	3/16
Poor preparation	11/16

(After) Final coursework grade or retake of ACS exam		
Very Good preparation	6/7 (ACS exam),	6/8 (B+ or better)
Average preparation	1/7 (ACS exam),	1/8 (B- or B)
Poor preparation	1/8 (< B-)	

Findings/Conclusion

We have data for the last 15 years on our 1^{st} year MS student on ACS standardized exams as a means of detecting gaps in student knowledge. The results above are typical.

- All students who retook the ACS exam vastly improved their first score.
- About 80% of students demonstrate **Very Good** preparation in 2 subjects after the first semester (12/15) and 13% were average (2/15). One student with poor preparation took an additional course in the second semester and re-took the ACS exam in that area (result was $>60^{th}$)

1b: Summarize relevant resources in the chemical literature The progress reports assignment consisted of: approved outlines from research directors, extensive formatting instructions and on-line grammar practice, peer-review of draft reports and a final revision scored by rubric.

<u>Rubrics on 6 students (first year MS students)</u>

Average score: on <u>Literature Form/Citations</u>: 4 out of 5 (all above the benchmark of >3 out of 5)

[Rubric scoring scale: 2 out of 5: "journals cited, but few articles" or 3 out of 5 "appropriate journals but shallow"]

Findings/conclusions. We will continue to alternate between oral presentations and written progress reports in Chem 698 to give students practice.

3a Good communication/teaching practice

We conduct an extensive student evaluation of the TAs in General Chemistry (27 questions) on the Lickert scale:

MS Chemistry Assessment 2009-2010: TA EVALUATIONS						
	Category Average on Lickert Scale (5=Outstanding, 3=Adequate, 1=Needs Improvement)					
	Fall 2009: Chem 111	Fall 2009: Chem 111	Sp 2010: Chem 113	Chem 260	Sp 2010: Chem 113	Chem 260
Average of averages	First year TAs (n=5)	*Second year TAs (n=4)	First year (n=4)	n=1	*Second year (n=4)	n=1
Personal and Professional 4 questions	3.97	4.68		4.80		4.95
Teaching Skills 10 questions	3.39	4.50		4.35		4.85
Planning and Preparing 7 questions	4.02	4.55		4.70		4.80
Classroom Management 5 questions	3.96	4.63		5.00		4.95
Overall (TA was effective teacher)	**3.78**	**4.58**	**4.32**	**4.67**	**4.73**	**4.89**
		*Includes 3rd year TAs	Chem 113 Category averages are not much different than Overall			

Findings: These results are typical. We find first year TAs almost always score lower than 2nd/3rd year TAs. The biggest score difference is on Teaching Skills (3.39 versus 4.50). The statements that need the most improvement are: stated goals of lab clearly, spoke clearly, wrote clear outlines and responded to student questions appropriately.

We see consistently high TA evaluations from the 2nd year TAs that we tracked from the first assessment report (n=2). One 3rd year TA scored a perfect 5.0 on "Overall, TA was effective teacher" in chem 113.

Conclusion: Our main conclusion is that teaching experience and English language proficiency in the lab are the largest determining factors in TA performance. We also note that there are better students in Chem 113 since the prerequisite is a C- or better in Chem 111.

We are looking into getting the USF Learning center involved in training sessions in the fall for new TAs and we will focus more effort into practicing Teaching Skill and Strategies.

3b Prepare professional reports/presentations and

Results of Spring 2010 Chem 698 Progress reports **(first year students only)**

Excellent 5 Good 4 Satisfactory 3 (benchmark) Unsatisfactory2

Structure	
Organization	4.2
Depth of evidence: assertions well supported	3.9
Emphasis of results	3.4
Transitions into sections	3
Language	
Targeting of audience (your research director is the audience)	3.8
Clarity of sentences (Ambiguity or Needless complexity)	3.8
Connections between sentences (Sentence variety, too much passive voice)	2.9
Energy: strong verbs; conciseness	3
Illustration	
Choice and design	4.5 (for all except 1 student, =2)
Introduction and explanation	3.2
Figure captions, Labeling and placement	3
Form	
Format: typography, layout, references (superscript[3] or [3] in-text citations)	4.5 except for 2 students = 2
Grammar: run-ons avoided	3.5
Punctuation	3.8
Usage: *affect*/*effect*, verb tense, pronouns	3
Chemical Literature appropriately cited and organized in ACS style	4

Findings: First year MS students are average technical writers. Sentence variety, connections between topics/sections and too much passive voice are the biggest issues. We discovered one case of plagiarism and learned this was partly cultural. The research director meet with the student to correct any misunderstanding and the report was rewritten.

2a. Students can safely operate and analyze results from research quality instruments for their project.

An informal discussion among the four faculty members and the technical staff reveals no major issues in this area. The written research progress reports all contain data from various instruments (UV-vis, NMR, AAS and MS) that are evidence for passing this benchmark.

5ab: Formulate and execute a plan to secure position after MS degree
Two students applied to PhD programs while consulting several faculty members. The plans were informal as both students did on-line research to target specific research areas. Both were accepted at many programs in the West (UCLA, UC-Irvine, USC, UC-Davis). Both will start PhD programs in Fall 2010.

c. What will be done differently as a result of what was learned?
Discuss how courses and/or curricula will be changed to improve student learning as a result of the assessment. Include a discussion of how the faculty will help students overcome their weaknesses and improve their strengths.

1a: Demonstrate Knowledge:
Again, the plan to address student weakness based on poor ACS exams or coursework has been in place for over 15 years. It is somewhat rare for students to not pass the exam on the second attempt, but 1 out of 7 fell into this category in 2009-10. After consulting with the research director, the student completed an undergraduate course in spring 2010 and fulfilled the requirement with a course grade of B and >60th percentile on the same ACS exam (given as a final exam in the course).

1b: Summarize relevant resources in the chemical literature: We addressed the poor results from year 1 assessment by giving a written progress report with literature citations (extensive handouts and on-line help). We will have students complete more peer-review of written and oral assignments in the Chem 698 course.

3a Good communication/teaching practice We completed a 1-day workshop for new TAs (teaching strategies and cultural issues with the USF Biology Department) in fall 2009 (Professors Margerum, King and Dever). Faculty in charge of Chem 111/113/260 will have specific TA meetings before classes start to review best practices for TAs in these courses. Faculty will also consider requiring more practice presentations in TA meetings. Finally, we will continue our practice of having first-year TAs attend the beginning of a lab section run by an experienced TA, before they teach the same experiment (mentoring or pairing new with experienced TA is very successful).

We moved one TA with very poor evaluations in Chem 111 to Chem 260 in the spring and assigned an experienced TA as a mentor. The first year TA observed the morning session and then took one group of 3 students for the afternoon session. The improvements in scores with this TA were dramatic (Chem 111 Overall 2.6 to Chem 260 Overall 4.67) and are due to experience gained in English, weekly TA meetings in which teaching skills are reviewed, the mentoring experience and more mature 2nd year undergraduates in this course).

Perceived grading differences among TAs, based on student survey comments, turns out to be unfounded. In spring 2010, the average Lab scores in each TA section did not vary by more than 6-8% (average 155/200). We will be clearer with TAs and students on how we grade (via rubric and exchange of lab reports).

3b Prepare professional reports/presentations. We find that students in Chem 698 did better on literature citations this year than with them on oral reports last year. We will provide more training in the fall on written reports and the issue of plagiarism (which came up in written reports this year).

Most of the lower averages are directly related to English as a second language for 3 out of 5 students. Those non-native speakers had much higher scores on the Language/grammar scores. This is not surprising. What to do? Give more practice and feedback on an individual basis. All students continue to give informal presentations in their research group meetings.

You can send your replies as either a Word attachment (to: marin@usfca.edu) or as a hard copy to: Provost Office, Lone Mountain Rossi Wing 4th floor. If you have any questions, please contact: William Murry, Director of Institutional Assessment (wmurry@usfca.edu or x5486).

E. Department policies and bylaws

Department Policy Regarding the Interaction of Faculty with Graduate and Undergraduate Research Students

The chemistry department at USF is a small community of scholars that encourages active collaborative undergraduate and graduate research with faculty members. We believe that part of a high quality research experience depends upon the professional and ethical conduct of the research faculty and students. Excellence in research is achieved when faculty and students are highly motivated by the work they are doing and respect one another's personal and professional goals. Chemistry faculty and research students must recognize that some types of behavior are offensive and harmful to others and that all of us have the right to expect high standards of behavior of one another. We should all strive to act responsibly and with sensitivity towards one another.

<u>To this end, it is essential that research advisors:</u>

- Conduct themselves in a mature, professional, and civil manner.
- Work respectfully with all faculty, students and staff regardless of race, gender, religion, sexual orientation, or national origin.
- Impartially evaluate student performance regardless of a student's race, gender, religion, sexual orientation, or national origin.
- Act in a manner that best serves the educational and professional needs of all of their research students.
- Attempt to maintain confidentially in communication with research students regarding their research performance and interactions with other students.
- Prevent personal differences with students, other faculty or staff from interfering with their duties as a research advisor.
- Provide research students with a clear understanding of their research responsibilities, including weekly time commitments and time line for completion of their research and thesis.
- Respect research students' need to allocate their time among competing demands.
- Refrain from asking students to attend to tasks not related to their academic or professional development.
- Make students aware that they can seek appropriate assistance for a grievance without threat of retaliation from themselves, another faculty member or administrator.

<u>To this end, it is essential that students:</u>

- Conduct themselves in a mature, professional, and civil manner.
- Work respectfully with all faculty, students and staff regardless of race, gender, religion, sexual orientation, or national origin.
- Take responsibility to inform themselves of the University regulations and policies governing their academic careers.
- Take responsibility for understanding laboratory protocols appropriate to their project and communicate with their research advisor before doing an experiment if they are unclear about a protocol.
- Come to an understanding with their research advisor regarding the time commitment associated with doing research.
- Recognize that their research advisor is responsible for monitoring the accuracy, validly, and integrity of their research.
- Understand that if they feel they are being mistreated, harassed, or discriminated against by any member of the department, including their research advisor, that they have an obligation to report their misconduct. To do so the student must contact any other faculty member in the department about the situation with whom they feel comfortable speaking. He/she will then serve as an advocate for the student. If the student is willing, the faculty advocate will setup and mediate a meeting between the student and the faculty member that they feel behaved improperly. If the mediated meeting does not lead to a satisfactory solution for the student, or if the student is unwilling to meet with the faculty member they feel has mistreated, harassed or discriminated against them, they will instead be asked to speak with the department chair to determine an appropriate course of action. In all cases the faculty member who the student feels has behaved improperly and the chair of the department will be informed that the student has reported the misconduct, unless the student explicitly requests, in writing, that they not be informed.

USF Department of Chemistry By-Laws (Approved 04/04/08)

I. Objectives

The objectives of the Department of Chemistry shall be:

1. To plan, organize, and deliver a sound, up-to-date curriculum to students obtaining a Bachelor of Science degree in Chemistry or Chemistry with an emphasis in Biochemistry.

2. To prepare students obtaining a Bachelor of Science in Chemistry, Chemistry with an emphasis in Biochemistry, and Masters students in Chemistry and Biochemistry for a professional career in chemistry, or chemistry related field, upon graduation from USF.

3. To offer a curriculum that can fulfill the requirements for American Chemical Society certification of the Bachelors degree in Chemistry.

4. To offer courses in sufficient number and in a predictable rotation for students obtaining a Bachelor of Science Degree in Chemistry or Chemistry with an Emphasis in Biochemistry to be able to graduate within a four year (i.e., 8 semester) timeframe.

5. To offer a research based Masters program in chemistry and biochemistry.

6. To maintain a dynamic departmental environment where undergraduate and masters students can obtain experience working with faculty on substantial and meaningful research projects.

7. To maintain a collegial and safe environment for all members of the department, including faculty (full-time and part-time), staff and students.

II. Membership

All members of the USF Faculty Association in good standing who hold academic appointment in the Department of Chemistry and primarily teach courses for the Department of Chemistry are voting members of the department. Part-time faculty are welcome to attend Department meetings as visitors.

III. Chairperson

1. The chairperson shall serve a three-year term beginning July 1st unless negotiated otherwise by the incoming and outgoing chairperson.

2. The chair shall be elected by majority vote of the full-time faculty members in accordance with the USFFA Collective Bargaining Agreement [section 25.3]; voting shall be subject to a simple majority of the voting members. Absentee ballots will be allowed. Should no one candidate for chair receive a majority vote a run-off election shall be conducted between the two top candidates. Any member of the department can request that voting take place secretly and in writing.

3. The chairperson shall represent the majority view of the department in all dealings with the administration.

4. The department chairperson shall attempt to represent the majority view of the department at all COSEC and College Council meetings and report all pertinent information from these meetings to the department members. In cases when the department chair cannot be present at such meetings they will either ask another department member to attend in their stead and/or be responsible for gathering the minutes from the meeting for distribution to their department members.

5. The chairperson, in collaboration with the department members, shall prepare the schedule of classes for submission to the Dean. The chairperson will maintain a file of potential part-time faculty, interview part-time faculty for specific course openings and recommend such faculty to the Dean as the need arises.

6. The chairperson, in collaboration with the department members, shall prepare a yearly workload rotation that projects the workload for all members over a two-year timeframe.

7. The chairperson, in collaboration with the department members and departmental program assistant, shall be in charge of all departmental review documents, including the ACS annual program review, ACS 5 year program review, and external program reviews.

8. The chairperson, in collaboration with the Dean's office of Arts and Sciences shall be involved in interviewing all potential staff members for the department and recommend such staff to the Dean as the need arises.

9. The chairperson shall keep records of the departmental budget, keep the department informed of the available operating budget at each department meeting, and in consultation with appropriate faculty and staff, allocate funding for course related materials, departmental office supplies and, after discussion with the department, selected capital equipment

IV. Department meetings

1. Department meetings shall be held once monthly during a semester, unless the chairperson determines that there are insufficient agenda items to warrant a meeting.

2. The chair shall solicit, in writing, agenda items from the department members. Agenda items shall be solicited sufficiently in advance of a scheduled department meeting.

3. Minutes shall be taken at all department meetings and distributed prior to the following department meeting.

4. Department policies shall be established at department meetings. For policies to be established a quorum must be present, where a quorum is a majority of the department. For items/policies where a vote of the membership is deemed necessary, as determined by any member of the faculty, members will vote verbally at a department meeting, unless any member of the department requests a secret, written ballot to be issued instead. All such items/policies will be established by simple majority vote.

V. Graduate Advisor

1. The graduate advisor shall be chosen by mutual agreement of the department and will serve a three-year term beginning July 1st, unless negotiated otherwise. Department members eligible to be graduate advisor shall be active participants in the graduate program.

2. The graduate advisor shall administer admissions to the graduate program including application file transfer from the admissions office to the department; routing applications to appropriate research directors; sending letters of acceptance and rejection to applicants; extending financial offers to accepted students; conducting phone interviews with accepted applicants to determine their ability to be a TA; overseeing the visa application processes.

3. The graduate advisor shall oversee the arrival of incoming of graduate students including providing housing, registration, and financial information; providing an academic orientation session; administering and evaluating qualifying exams.

4. The graduate advisor shall monitor and mentor the students enrolled in the graduate program including overseeing their timely progress through the program; serving as an advocate for them, individually and collectively; overseeing the disciplining and/or sanctioning of students who do not fulfill the academic requirements of the program or do not adhere to the policies regarding collegial conduct in the department; assisting students in seeking funds for professional development activities.

5. The graduate advisor shall maintain and enhance the graduate program by actively participating in recruitment efforts; administering maintenance of the University catalogue copy related to the program and the program website; seeking adequate funding for graduate students research and teaching assistantships.

VI. Amendments to By-Laws

The Department of Chemistry By-laws may be amended by a simple majority vote of the department.

VII. Subordination

No part of the Department of Chemistry By-laws or proceedings shall stand in contradiction to the constitution of the USFFA, the Collective Bargaining Agreement, the By-Laws of COSEC, or other published policies of the USFFA.