DEPARTMENT OF CHEMISTRY

PROGRAM REVIEW

SPRING 2014

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Program Introduction and History

1) Department Summary

A) Degree offerings

BS: Chemistry
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B) Faculty Members

Full Time Faculty: 7
(See **Appendix A** for Faculty CVs)

Carmen F. Works-joined SSU 2001

(Ph.D. UCSB 2001; Professor)
Bioinorganic Chemistry
Dr. Works' training is in the area of bioinorganic chemistry and focuses on the molecule role of transition metals in biological systems. She received her B.A. in chemistry from San Francisco State University where her undergraduate research was concerned with the synthesis and characterization of organometallic catalysis. Dr. Works completed her Ph.D. at University of California, Santa Barbara and her project concerned the synthesis and photochemical studies of ruthenium Salen nitrosyl compounds as possible chemotherapeutic agents. Dr. Works' training has given her a background in air, light, water sensitive synthesis, biochemistry, spectroscopy and kinetics. Her current research is concerned with determining the mechanisms of; iron-only hydrogenase (an organicmetallic enzyme that reversibly catalyzes the oxidation of molecular hydrogen), chromium(III) binding proteins and chromate reductase.

Jennifer Lillig- joined SSU 2003

(Ph.D. UCSD 2001; Professor)
Biophysical chemistry
Jennifer Whiles Lillig received a B.S. in Chemistry from Harvey Mudd College and a Ph.D. in Chemistry from UC San Diego. She specializes in biochemistry and her research is focused on characterizing structure:function relationships in membrane-active antimicrobial peptides and proteins. She teaches across the department curriculum including general chemistry, general/organic/biological chemistry for pre-nursing students and upper-division and capstone experiences in biochemistry. Her teaching emphasizes chemical problem solving, experimental design and data analysis, writing and reading the chemical literature, and teamwork

Meng-Chih Su-joined SSU 2006

(Ph.D. University of Arkansas 1986; Full Professor)
Physical Analytical Chemistry
Meng-Chih Su received a B.S. in Chemistry from Soochow University, Taipei, Taiwan and a Ph.D. in Chemistry from University of Arkansas. His research focuses on the understanding and characterizing protein adsorption to substrate and its applications in biosensors, biomedical devices and other biotechnologies (protein

chip technologies). In particular, the denaturation effect on surface bound proteins is studied in his research group with use of prototype heme protein cytochrome c on fused silica surface.

Steve Farmer-joined SSU 2006

(Ph.D. UCD 2001; Associate Professor)
Organic Chemistry
Dr. Farmer's training is in the area of organic chemistry and his Ph.D. thesis was titled "A Synthesis Route for Ellipticine Via Sulfur Extrusion." This project involved the synthesis of the natural product ellipticine using organic chemistry techniques. In addition, his research group is currently involved in two projects that directly utilize organic chemistry. The first is entitled "Development of a Sulfur Extrusion Route to Carbazole Natural Products" which directly uses organic synthesis techniques for the synthesis of natural products. The second is entitled "Investigation of fluorescent molecules from Naematoloma Fasciculare" which involves the isolation of natural products from local mushrooms.

Jon Fukuto- joined SSU 2008

(Ph.D. UCB 1983; Professor)
Bioorganic, Organometallics
Small molecule signaling species (i.e. NO, CO, H_2S and O_2 and their derived species) are involved in a wide array of physiological function. For example, they are all important in the regulation of the cardiovascular system, cell-cell signaling and neurotransmission, just to name a few. In spite of their biological importance, the chemistry by which these agents elicit their activity is poorly understood. Thus, research in the Fukuto lab focuses in the chemical biology of these small molecule signaling agents. That is, the Fukuto lab endeavors to determine the relevant physiological chemistry of NO, CO, H_2S and O_2 and their chemical interactions with biological systems as a means of understanding their utility as important physiological mediators and effectors.

Mark Perri- joined SSU 2009

(Ph.D. UCB 2003; Assistant Professor)
Environmental, analytical
Dr. Perri's group studies the impact of anthropogenic pollution on our local atmosphere. Projects include measurements of: trace pollutants in our atmosphere by Gas Chromatography - Mass Spectrometery, aerosol optical thickness ("haze"), and ozone. These measurements are used along with computer modeling programs, to understand the types of processes that cause atmospheric pollution and to design control strategies for our unique local region Recently his groups has also been using ion chromatography to quantify pollutants in river water, in order to understand and limit our University's impact on our local watershed.

Monica Lares- joined SSU 2013

(Ph.D. UCSC 2009; Assistant Professor)
Biochemistry
The Lares lab is working on identifying key interactions between the B-cell-activating factor receptor (BAFF-R) protein and a RNA aptamer that specifically binds BAFF-R. BAFF-R is expressed on B-cells and overexpressed in non-Hodgkin's lymphoma. When BAFF-R's ligand, B-cell-activating factor (BAFF), binds, proliferation and cell survival increase allowing the cancer to spread faster. Aptamers are capable of binding their targets with high specificity and affinity and have recently been investigated for their therapeutic advantages over antibody-based approaches. An RNA aptamer has been identified that efficiently binds BAFF-R, thus preventing binding of its ligand. The RNA aptamer has also been used to deliver therapeutic reagents that kill the cell. We are working on identifying the specific amino acids of BAFF-R that are responsible for the

binding of the aptamer using site-directed mutagenesis. We also want to identify the nucleotides of the RNA aptamer that specifically bind BAFF-R using RNase protection assays. Understanding the specific interactions between BAFF-R and its aptamer would allow us to increase specificity, reducing off-target effects, and facilitate this therapeutic approach through clinical trials.

Emeritus Faculty:

Gene Schaumberg (1965-2003)
Don Marshall (1966-2003)
Marvin Kientz (1967-1998)
Floyd Leslie Brooks (1968-2005)
Doug Rustad (1969-2000)
Vincent Hoagland (1969-2005)
Dale Trowbridge (1969-2008)
Dave Eck (1970-2006)
Doug Martin (1984-2005)

Part-time faculty as of Spring 2014
Jacquelyn Guilford
(Ph.D. Pennsylvania State University College of Medicine 2007; Molecular Toxicology)

Kristylea J. Ojeda
(Ph.D. Marquette University Milwaukee, Wisconsin 2009; Molecular Biology)

Monali Joshi
(Ph.D. University of California, Los Angeles 2009; Materials Science and Engineering)

Zachary Sharrett
(Ph.D. University of California, Santa Cruz 2008; Organic Chemistry)

Christopher Dudzik
(Ph.D. Unversity of California, Santa Cruz 2006; Chemistry)

C) Students

Chemistry BS majors: 42

Biochemistry BS majors: 83

Chemistry BA majors: 25

Total number of chemistry majors: 150

Chemistry minors: 15

D) Support staff

Christy Gorman (Chemistry Stockroom Technician 80%)

Andrea Cullinen (Administrative Coordinator 50%)

John Collins (Instrument Technician 50%)

2) The discipline of chemistry

Chemistry is a broad area of physical science that is concerned with matter and how it changes. The field of chemistry has traditionally been broken down into 5 sub-disciplines (physical, analytical, biological, organic, inorganic) that have blurred boards, and it is very common for a chemist to be trained as a hybrid between two or more of these sub-disciplines. Cutting edge research in the field does not let a chemist confined him or herself to one area and the discipline now encompasses environmental, materials/nanotechnology, medical/pharmaceutical, and engineering. There are endless applications of chemical research, in addition to the importance of fundamental research and knowledge of the chemical sciences. Since chemistry is a broad discipline it crosses over with other sciences, such as biology and physics. The main defining factor of chemistry is the study of molecules and molecular processes.

Physical chemistry is concerned with quantum mechanics, spectroscopy, thermodynamics and kinetics. Traditionally physical chemists have worked with gas phase molecules and while there are still studies in the gas phase most now work in solution and the solid state. Many physical chemists also perform computational modeling of molecules, solutions and dynamic interactions.

Analytical chemistry is concerned with error, measurements, and experimental reliability. Since all chemists must make accurate and reliable measurements this sub-discipline has been merged with the other areas of chemistry over the years.

Organic chemistry is the study of hydrocarbons and derivative of hydrocarbons. A large number of organic chemist are total synthesis which means that they work on ways to make new molecules or better ways to make molecules that are in demand. A large number of such molecules are used by the pharmaceutical industry to relieve illnesses. Another area is called natural product chemistry and these chemists are concerned with the extraction of molecules from their sources that are naturally occurring. In addition, some chemists are natural product synthetic chemists. These molecules are purified and the structure solved. The solving of molecular structure involves the use of x-ray crystal refractrometry or a combination of spectroscopic and mass spectrometry techniques and crosses over with physical chemistry. Many organic chemists refer to themselves as physical organic or synthetic organic chemists defining their training in this area. Recently organic chemists have also been defined as bioorganic chemists. Bioorganic chemists can also be physical or synthetic but apply their knowledge to organic molecules in biological systems. Additionally many bioorganic chemists are concerned with mechanisms of biological processes.

Inorganic chemistry is the study of molecules that are not made of hydrocarbons except for when they are bound to a transition metal. This board sub-discipline is concerned with the study of transitions metals, rare earths, small molecule activation, materials, organometallics and catalytic processes, biological processes of small molecules, transition metals and enzymes, environmental studies and, synthesis and spectroscopy. For example a large area of inorganic chemistry is the creation of new catalysis, which would be the area of synthetic inorganic chemistry. However, there are also inorganic chemists that are concerned with how these catalytic processes work on the molecule level and use many kinetic and spectroscopic techniques, and would be referred to as physical inorganic chemists. Over the last 20 years the area of bioinorganic and materials chemistry has grown and are also grouped in this sub-discipline

Biochemistry is the study of chemistry in biological systems, and therefore applies all of the sub-disciplines of chemistry. Biochemist can come from either a biological background or a chemical background but both are concerned with the chemistry of life processes.

A recent trend in chemistry has been to apply knowledge of chemistry to study biological processes, create nano scale materials, and solve environmental problems. In order to work in such applications a person needs a firm foundation in the basic chemical principles, and that is one area that we strive for as an undergraduate institution.

3) The chemistry program at SSU

A) Mission Statement

The mission of the department of chemistry at Sonoma State University is to create a scholarly learning environment for students, faculty, and staff that leads to the graduation of undergraduate students that are active and life-long learners in the field of chemistry. All members of our community will be or become independent thinkers that are competitive in the field and understand chemistry as a foundation science. We work to achieve these goals and advance the understanding of chemistry through an integrated experience of education and research that fosters collaboration and teamwork. The department's approach to problem solving, critical thinking and the use of analytical and deductive reasoning skills produces students who are creative problem solvers, skilled scientists and productive members of society.

B) Learning outcomes for the overall program

1. Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)
2. Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).
3. Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),
4. Understand the concepts of acids and bases, neutralization and buffers
5. Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.
6. Data manipulation and interpretation
7. Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design.
8. Working skills and knowledge in instrumentation and computer literacy
9. Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.
10. Reading and interpretation of chemical literature and communication skills (oral and written)
11. ability to implement career planning

C) Coverage of the learning outcomes in chemistry courses

Learning Outcome	Dissemination
Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)	Physical chemistry, general chemistry, organic chemistry, biochemistry and pchem lab
Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).	Organic, 115B and 125, 445, 325 and pchem lab
Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),	Quant, general chemistry, pchem lab, 441, 401 and 494
Understand the concepts of acids and bases, neutralization and buffers	115A/B, 255, 335A/B, 445, 441, and 325
Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.	115A/B, 335A/B, 401, 325, 310A/B, 446 and 255
Data manipulation and interpretation	255, 115A/B, 336A/B, 310A/B, 441, 402, 401, and 494
Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design.	All lab courses and research
Working skills and knowledge in instrumentation and computer literacy	401, 225, 335A, 125, 494, 115, 441, and 402
Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.	335A/B, 115A/B, 310B, 325 and 401
Reading and interpretation of chemical literature and communication skills (oral and written)	125, 325, 401, 497, 494, 310A, 310B, 445, 446, 441, and 336A/B
Ability to implement career planning	497 and 494

D) Department Goals and Measurable Objectives

1. Goal: deliver a modern curriculum in both content and pedagogy that extends beyond the standard classroom experience

Measurable Objectives:

A) Offer electives in current topics (3-6 units) to bring our department in line with other chemistry departments in the CSU and nationally
B) Follow ACS guidelines for course offerings
C) Offer a year-round seminar program
D) Utilize current educational techniques and technologies like clickers, peer-led instruction, collaborative learning
E) Offer integrated capstone experiences with a written thesis
F) Provide student access to modern instrumentation and an instrumentation class

2. Goal: provide realistic, cutting-edge, and quality year-round research training

Measureable Objectives:

A) Faculty are successful in publishing and obtaining funding for their work
B) Faculty and students attend conferences and present results at conferences and other universities
C) Offer a year-round seminar program
D) The department is successful in acquiring and maintaining modern instrumentation
E) The department receives support from its school and university (monetary, appropriate credit to faculty for supervising undergraduate researchers and writing grant proposals, technician support, matching funds)
F) Students successfully gain entrance into graduate school or industry jobs
G) Hold regularly scheduled group meetings

3. Goal: help students prepare for their future in a manner that will allow them to be successful

Measurable Objectives:

A) Students successfully gain entrance into graduate school or industry jobs
B) Students successfully complete an independent laboratory project
C) Students effectively communicate their laboratory work in oral, written, and poster formats.
D) Provide opportunities for students to hold TA/SI/peer-instructor positions with proper training

4. Goal: nurture students and mentor them through individualized and honest guidance for their scholarly development

Measurable Objectives:

A) Require annual advising appointments for every chemistry major
B) Maintain a faculty and staff that are accessible to students for questions and conversation
C) Hold regularly scheduled group meetings
D) Provide 4-year (or appropriate) academic planning for entering students
E) Maintain and support a chemistry club
F) Provide information and knowledge for career opportunities

5. Goal: engage in meaningful conversation about and provide support for professional development of faculty and staff

Measurable Objectives:

A) Hold annual retreats to discuss curriculum and programming
B) Maintain a yearly seminar program
C) Obtain resources for faculty to attend workshops and conferences in teaching and research
D) Provide opportunities for staff to attend training workshops in their field
E) Provide appropriate credit and time for the preparation of research proposals and publications
F) Obtain adequate facilities to house scholarly endeavors
G) Provide networking opportunities for faculty to visit other departments and exchange ideas

6. Goal: have a high quality department in terms of students, faculty, staff, available resources, and modern facilities and instrumentation

Measurable Objectives:

A) Obtain a high-field NMR and LC-MS
B) Obtain an NSF-REU
C) Obtain an instrument technician
D) Implement a minimum "C" requirement in all chemistry courses for chemistry majors
E) Provide honest and thorough performance reviews for all faculty and staff
F) Utilize CHEM 125AB as a tool ("Freshman Experience") for preparing chemistry majors for upper division coursework
G) Provide opportunities for interested students to participate in scholarly activities outside the classroom
H) Partner with local high schools and JCs to facilitate the transition of students into our program
I) Hold advising open-houses for potential majors
J) Allow majors to repeat a total of 3 chemistry classes, they must meet with the department curriculum committee to discuss their new academic plan for success in the course; students with special circumstances may petition the department to waive this requirement
K) Require an overall 2.0 GPA requirement in the chemistry major for graduating chemistry majors

7. Goal: work collaboratively, work as a team, and maintain close working relationships within our chemical community and the community at large

Measurable Objectives:

A) Establish partnerships with local schools and industry
B) Obtain an NSF-REU
C) Hold annual gatherings for members of the chemical community
D) Provide support for the Chemistry Club
E) Hold an annual team-building exercise for all faculty and staff
F) Provide opportunities in the classroom for students to solve problems together

D) Learning Outcomes for Specific Degrees

BA Chemistry Learning Outcomes

1) Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)
2) Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).
3) Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),
4) Understand the concepts of acids and bases, neutralization and buffers
5) Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.
6) Data manipulation and interpretation
7) Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design.
8) Working skills and knowledge in instrumentation and computer literacy
9) Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.
10) Reading and interpretation of chemical literature and communication skills (oral and written)
11) Ability to implement career planning

Learning Outcomes Specific for BS Chemistry

12) Students demonstrate a working knowledge of advanced lab techniques and skills.

13) Students develop a deep mathematical foundation for application to chemical problems.

14) Students can use their foundation knowledge to implement experiments for a novel research problem and demonstrate scientific independence.

Learning Outcomes Specific for BS Biochemistry

12) Students demonstrate a working knowledge of advanced lab techniques and skills.

13) Students can use their foundation knowledge to implement experiments for a novel research problem and demonstrate scientific independence.

14) Students demonstrate a conceptual understanding of the structure:function relationships of biological molecules and how these relationships dictate chemical reactivities in metabolism and life.

E) Learning Objectives for specific courses

The learning objectives for specific chemistry courses can be found in **Appendix B**

F) 4-Year Plans

The 4-year plans for the chemistry department can be found in **Appendix C**

G) Facilities, Equipment and Other Resources

The Department of Chemistry has approximately 13,000 sq. ft. of dedicated laboratory space on the third floor of Darwin Hall, recently remodeled in 2007. This space is divided into two general chemistry teaching labs (D326, D328), an organic chemistry lab (D323), an instrument room (D322), and four labs solely for undergraduate research (D327, D317, D314, D320). The teaching labs are accessible for research during regularly scheduled classes (space, instruments, and class format permitting) and are dedicated exclusively to research during summer, winter, and spring breaks. The department also as chemistry department space, 414 sq. ft., established for molecular biology and protein purification in Salazar 2000, located next door to Darwin Hall. Finally, the chemistry department as an approximately 150 sq.ft basement room in Darwin Hall (D36) which houses the 400 MHz NMR. Recently, the chemistry department has acquired half of the radiation capable lab in room D306. An additional space for lower division laboratories is located in Carson 1.

All faculty and senior personnel have desktop computers that are in the process of being upgraded during the spring semester 2011. All faculty have direct access to scanners and color laser printers. The computers have internet access and all faculty and senior personnel have dedicated office space of approximately 110 sq. ft., located on the third floor of Darwin Hall. The offices have windows that face into the dedicated research lab spaces and side-doors with lab access.

The chemistry department has a shared conference room (Room 300C) that is used for group meetings. The university has a state of the art library with licenses to over 1500 journals including all of the ACS journals and a site license to access Sci-Finder Scholar. The faculty and students have access to all library holdings from any computer on or off campus. The Chemistry Departments also maintains a stockroom.

Major equipment

400 MHz NMR spectrometer: D336
60 MHz NMR spectrometer: D322
FT-IR spectroscopy (X2),
Optical Spectrometers (diode array and dual beam): D320
Atomic Absorption Spectrometer: D327)
GC-Mass Spec (X2): D322
LS 50B Fluorimeters (X2, including polarizers and plate readers):
lab and Darwin 320
HPLC with dual wavelength detection, fraction collector, in-line degasser:
Additional HPLCs with autosamplers: D322
Equilibrium dialyzer:
Lipid extruder:
Schlenk line for lyophilization:
Electrophoresis and Western Blot equipment:
Incubators and shakers: D320, Salazar Hall
PCR machine: Salazar Hall 2000
Chromatography Fridge: Darwin 322
Refrigerated Sorvall RC-6 centrifuge:
Refrigerator and full-size freezer:
Hoods and Rotovaps: and D323

Self-Study

1) Curriculum

A) The core curriculum of the majors

1. We offer two foundation courses, first a General Chemistry course for students with little to no previous background in chemistry, and second an Honors track for students with a prior chemical background. The Honors foundation course is accelerated and has an emphasis on analytical skills, and instrumentation. Both courses introduce many of the basic concepts and calculations used by chemists.
2. Organic Chemistry is a course that expands the basic knowledge learned in general chemistry about molecular structure and expands that to the study of organic molecules.
3. Quantitative Analysis is a course which focuses on analytical skills for those chemistry majors who have not completed the Honors general chemistry track.
4. Physical Chemistry is a course that expands the basic knowledge learned in general chemistry about thermodynamics and quantum mechanics
5. Inorganic Chemistry course merges many of the concepts and ideas learned from the student's previous chemistry courses. The course looks at the bonding and spectroscopy of both small molecules and transition metal compounds. The course examines the reactions and reaction mechanism of inorganic, organometallic and bioinorganic molecules. Lastly, the students study the applications of this field by reading the current literature.
6. Biochemistry is a yearlong course and a capstone lab experience. The first semester lecture course examines the structure and function of biological molecules, and the second semester focuses on metabolism. The lab experience is a project based lab on enzyme purification.

B) Research

An especially important aspect of any undergraduate chemistry curriculum is research. In today's world, students intending to pursue post-baccalaureate training in PhD graduate programs, Medical School, Pharmacy School, etc. are not competitive without a significant undergraduate research experience. Moreover, it is evident that research experiences at the undergraduate level (as well as in High School) are an important aspect of encouraging talented students to pursue advanced degrees and careers in chemistry. Research experiences teach students critical thinking and educates them with regards to the "scientific process and method", allowing them the opportunity to see for themselves how science is created and how it evolves. Evidence for the importance of research in an undergraduate chemistry curriculum and its impact on student outcomes was previously mostly anecdotal. However, a recent study performed by SRI for the National Science Foundation (NSF) involving over 15,000 survey respondents unambiguously confirms this (1,2). This report found that undergraduate research opportunities (UROs) significantly enhanced understanding, confidence and awareness as well as clarified interests in STEM (science, technology, engineering and science) careers. Indeed, 68% of students in UROs were found to have a significantly increased interest in STEM careers and twice as likely to pursue a PhD. Thus, it is clear that the inclusion of UROs is essential to any chemistry curriculum and the conclusion of this study was that greater attention should be given to UROs at all levels of education. Another recent article indicates that the demand for talented researchers is outpacing the supply and that there is an ongoing problem of attracting talented students to all areas of science, especially chemistry and physics (3). Indeed, these trends and the expectation that UROs represent part of the solution to this problem prompted the NSF in 2001 to encourage and emphasize undergraduate research in the granting process. This increased emphasis on undergraduate research by the NSF acknowledges the importance of undergraduate research, something other countries are beginning to realize as well (3).

The importance of providing research opportunities for the students is clear. However, it is also worth noting that research has benefits to the research mentors as well. The opportunity for critical thinking, to remain current with the scientific literature and to discuss cutting-edge science is of paramount importance to their development as instructors and scholars. Many things learned and discovered through research endeavors find their way into the curriculum and lectures. Thus, research offers an important avenue for Professors to evolve with their disciplines, increasing their ability to stay current with their teaching and increasing their scholarship.

The advantages of achieving gender, ethnic and cultural diversity in chemistry (and other STEM disciplines) are clear, as yet unrealized (for example, 4) and an institutional goal. Since the utility of UROs in the recruitment and retention of students in these disciplines is clear (*vide supra*), the importance of research in achieving diversity is paramount. Coupled with outreach programs and institutional partnerships, the existence of research opportunities for under-represented populations is fundamental to the goal of achieving diversity as these students will undoubtedly be more apt to develop an interest in chemistry and pursue further training, ultimately leading to a career. Thus, there is little doubt that research is an extremely fundamental and important part of a chemistry curriculum, with hugely positive effects on numerous aspects of student training, faculty development and other institutional goals.

1. Russell SH, Hancock MP, McCullough J (2006) *Evaluation of NSF Support for Undergraduate Research Opportunities*. Arlington, VA, USA: National Science Foundation.

2. Russell SH, Hancock MP, McCullough J (2007) THE PIPELINE: benefits of undergraduate research experiences. *Science* **316:** 548–549.

3. Hunter, P. (2007) *EMBO Reports*, 8(8), 717-719.

4. *A Report from the Undergraduate Research Summit,* Bates College, Lewiston, ME, August 2–4, 2003 (http://www.bates.edu/x50817.xml).

C) The Minor

The Chemistry Minor was created to allow students whom have taken a substantial amount of chemistry to highlight their effects. The curriculum for a minor in chemistry is shown in **Appendix C**. The vast majority of students that apply for chemistry minor are biology majors, because quantitative analysis is the only additional course work that is required in their supporting coursework.

D) Course offerings

See **Appendix D** for the SSU chemistry department's course offerings and course descriptions

E) Changes to the curriculum since the last program review

Introduction of Chemistry 125

Replacement of Chemistry 115AB with Chemistry 125AB in Our Four Year Plan – The majority of our first-year chemistry majors enter SSU already with a background in chemistry. Many of these students have taken high school or AP chemistry, the latter, which is equivalent to our general chemistry series. In order to challenge our chemistry and biochemistry majors we created an honors chemistry track, which includes analytical skills, in an accelerated foundations course. This course also allows us to focus on topics, which are very important for our majors, and allows the general chemistry course (CHEM 115AB) to be broader for other majors that need a chemical foundation. Students that take the 115AB series can still proceed with chemistry major with the addition of a one semester Analytical Chemistry course (CHEM 255).

Introduction of Chemistry 315/316

Replacement of Chemistry 494 as a required course with Chemistry 315/316 (Introduction to Research Methods in Chemistry) and, an increase of 1 unit for the undergraduate research requirement- undergraduate research in chemistry is invaluable for our majors to be competitive for both the industry market and graduate school. Knowing the importance of this skill the department made research a requirement for both BS degrees in 2004. Since the implementation of this requirement the number of majors in our department has grown significantly while the number of tenured-tenure-track faculty has not. In addition, we realized that a more structured research requirement is needed for the majority of our students to accomplish measureable research goals. Therefore we are proposing to formalize the research requirement into a structured yearlong course and increase the amount of units dedicated to this endeavor by 1. The increase of 1 unit compliments the additional course work that will now be required of our research students. Based on student success in our project based capstone courses, we anticipate greater research progress for our students during this time frame, increased opportunities for students to pursue advanced research training in Chemistry 494, and a greater likelihood that students will be co-authors and/or presenters for scientific publications, posters, and seminars.

Elimination of Chemistry 316 (Physical Chemistry lab), Changes to Chemistry 401, Addition of chemistry 275

Incorporation of the physical chemistry lab into our capstone 401 course- The 401 course will combine advanced laboratory techniques from physical, organic, inorganic, and instrumental analysis, and serve as one of the capstone experiences for our majors. The combination of the sub-disciplines into one lab course will teach the students that real-world chemical problems require interdisciplinary and integrated solutions. This combined laboratory course will prepare students for a further career in research, in either graduate school or industry.

Removal of the instrumental lecture portion of Chemistry 401 and creation of a stand alone instrumental lecture course- Chemistry 401 will be further converted into an integrated lab course, with only a portion devoted to instrumental analysis. Consequently the instrumental analysis lecture will not match well (from a pedagogical view) with all of the labs, and we will require lecture time on other lab experiments. Separating the instrumental lecture into its own course is thus necessary. Addition of an instrumental analysis course is required by the American Chemical Society as part of our curriculum to maintain our BS Chemistry degree certification. We tried to satisfy this required by incorporation into our capstone course but the students are not getting the material that they need.

Introduction of Chemistry Elective 496

Incorporation of two Chemistry electives into the BS Chemistry track – As described in our program review, chemistry is a broad discipline with many applications and overlaps with other areas of science. Currently our students have a solid groundwork in the chemical foundations but lack any advanced training in cutting edge chemical topics. At many other 4-year Universities, undergraduate students have access to advanced topics in chemistry or cross-listed graduate courses. Due to the fact that we do not have a graduate program, our students do not have this important opportunity. This is a huge disadvantage for our majors, and the addition of electives with advanced cross-disciplinary topics will help our students grow and become more competitive for industry and graduate programs.

Increase in the number of elective course units- Other than seminar, there are no 1 unit course in the chemistry department and there are plenty of elective units in the BA, therefore it makes sense to increase the elective units in chemistry to be equivalent to a lecture course, 3 units.

F) Contributions to general education

The chemistry department offers six courses which can be taken for GE credit.
CHEM 102, CHEM 105, CHEM 110, CHEM 115A, CHEM 115B, CHEM 125A

The chemistry department participated in the GE B1 assessment process, Fall 2010

Faculty teaching in GE B1 courses (CHEM 102, CHEM 105, CHEM 110, CHEM 115A, CHEM 115B, CHEM 125A) used the rubric provided by the GE subcommittee and an assessment tool of their own choosing to assess if their students were achieve the GE B1 Learning Objective: *Understand the physical world through interpretation of results from experimentation and/or observation.* Chemistry faculty chose to use embedded questions in their regular exams that represented the learning objectives and then assigned a % correct required for each portion of the assessment rubric (Not Meeting, Approaching, Meeting, Exceeding). On average, students in these classes were found primarily to be meeting the learning objective. The Chemistry Chair represented the department at the follow-up meeting of these assessment results with the GE Subcommittee. During this meeting we noted that some of the instructors utilized their entire exam as the assessment tool rather than picking questions off of the exam that were specifically geared toward the learning objective being assessed and we plan to make sure we are more clear on how to select appropriate embedded questions in the future.

G) Curricula comparison to other CSU chemistry departments

Course	Sonoma	San Marcos	Bakersfield	San Bernardino	Chico	Humboldt	Stanislaus	Dominguez Hills	Channel Islands
Chemistry in Society	X		X	X	X	X	X	X	X
Intro to General Chemistry	X		X	X		X		X	X
Combination Gen / Org Chemistry for Nursing	X	X	X	X	X	X	X		
Year-Long General Chemistry + Lab	X	X	X	X	X	X	X	X	X
Quantitative Anal. + Lab	X	X	X	X	X	X	X	X	X
Year-Long General Chemistry With quant. + Lab	X								
One Semster Organic Chemistry For Non-Science Majors					X	X			
Year-Long Organic Chemistry + Lab	X	X	X	X	X	X	X	X	X
Introduction to Pysical Chemistry for bio. Students				X		X			
First Semester Physical Chemistry Lecture	X	X	X	X	X	X	X	X	X
Second Semester Physical Chemistry Lecture	X		X		X	X	X	X	X
First semester Physical Chemistry Lab		X	X	X		X	X		X
Second Semester Physical Chemistry Lab			X				X		
First Semester Inorganic Chemistry Lecture	X		X	X	X	X	X	X	X
Second Semester Inorganic Chemistry Lecture				X	X	X			
One Semester Inorganic Chemistry Lab			X	X		X	X		
One Semster Biochemistry for Nurses				X	X	X			
First Semester Biochemistry lecture	X	X	X	X	X	X	X	X	X
Second Semester Biochemistry lecture	X		X	X	X	X	X	X	X
Intro to Research Methods	X								
Biochemistry lab	X	X	X	X	X	X	X	X	
First Semester Intergrated Lab	X			X	X		X	X	
Second Semester Intergrated lab	X				X		X	X	
Seminar	X		X	X	X	X	X		X
Instrumental Analysis	X		X	X	X	X	X		X
Biologica Chemistry									X
Clinical Chemistry								X	
Chemical Thermodynamics					X				
Molecular Modeling						X			
Environmental Chemistry		X	X	X	X	X	X		X
Environmental Toxicology									
Concepts of Geochemistry			X					X	
Energy in Society		X							X
Science of Winemaking			X				X		
Toxicology					X			X	
Forensic Chemistry			X				X		X
Synthetic Organic Chemistry					X				X
Physical Organic Chemistry					X				
Advanced Organic Chemistry						X	X		
Advanced Organic Laboratory					X	X			
Selected Topics in Chemistry	X				X	X	X	X	X
Undergraduate Research	X		X	X	X	X	X	X	X

(Figure 1)

In this comparison **(Figure 1)** the curriculum for eight other CSU chemistry departments which are of a similar size as SSU. At first glance it may appear the SSU chemistry department may be lacking an inorganic and physical chemistry lab. The SSU chemistry department decided to incorporate inorganic and physical chemistry experiments into their first semester integrated laboratory. However, upon close examination the SSU chemistry department is one of the only chemistry departments investigated which does not regularly offer an environmental chemistry course. It should be noted that the SSU chemistry department is only one investigated which offers a year-long general chemistry with quantitiave analysis sequence and a year-long research training course.

2) The Department

A) Advising

Currently all tenure and tenured track members of the department play a role in our advising process. We have designed a lead advisor and their duties are to maintain a current and accurate list of the majors, assign the majors to an advisor, keep advising sheets up-to-date, and contact students regarding advising holds and the advising process. The other members of the faculty meet with their designated advisees on a regular basis which is typically once per semester. The department keeps an advising folder for each major in the department office so that any faculty member can help our students. This record is dynamic and updated during the course of the student's studies.

B) Chemistry club

The chemistry department has an active chemistry club with an average of 20 members. The chemistry club has been increasingly active with community outreach events such the National Chemistry Day demonstrations and attending the science fairs of local elementary schools. Also, the chemistry club has increased holding social events such as; ski trips, hosting invited speakers, trips to local theme parks, and tours of local industries. The chemistry club is supported by the chemistry department thought the sales of laboratory manuals.

C) Department website

The Chemistry Department's website contains the following:

Adds for faculty positions
A Description of the department
A Faculty and Staff Directory and Faculty office hours
4-Year plans and learning outcomes for the department
Course Descriptions and Schedule
Descriptions of Faculty Research
A Seminar Schedule
Chemistry Club Page
Alumni Page
Donations Page
Links to other chemistry websites

D) Facebook alumni site

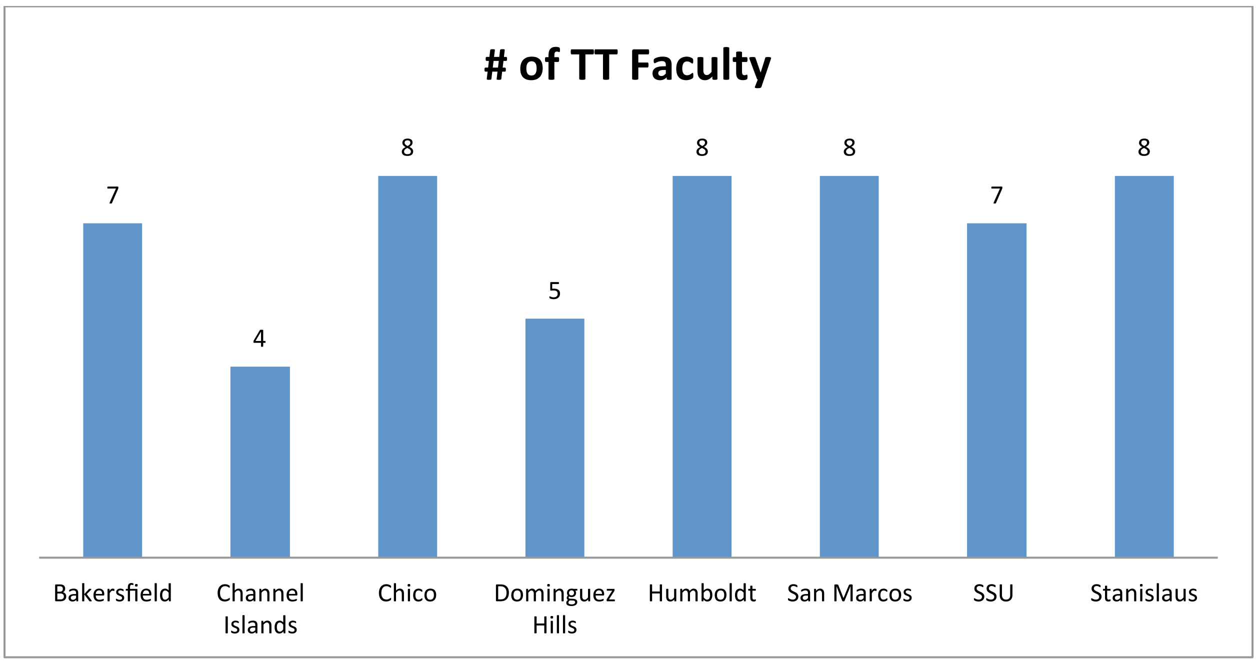
The SSU chemistry department has a defined presence on Facebook and LinkedIn. This presence has allowed for continued connection with recently graduated alumni and reconnection with past alumni. The chemistry department has developed an alumni Facebook page which has over 200 joined alumni. This site is used to update alumni about department news, job posting, and other related chemistry material. In total, this effort has allowed for connection with roughly 50% of the department's alumni and was unique enough to be formally published (Farmer, S. C. Using Social Networking Sites to Connect with Chemistry Alumni. *J. Chem. Ed.* **2013**, 90, 673-675). In addition, the chemistry department has increased efforts to invite alumni to campus to give seminars. Every year the department tries to invite 1-2 past alumni to give a seminar regarding their current work and/or careers.

E) Comparison to other CSU chemistry departments of a similar size to SSU

For these comparisons CSUs with a similar number of chemistry majors, which give out a defined chemistry bachelor's degree, and do not give out a masters degrees were chosen.

Number of tenure track faculty (Figure 2)

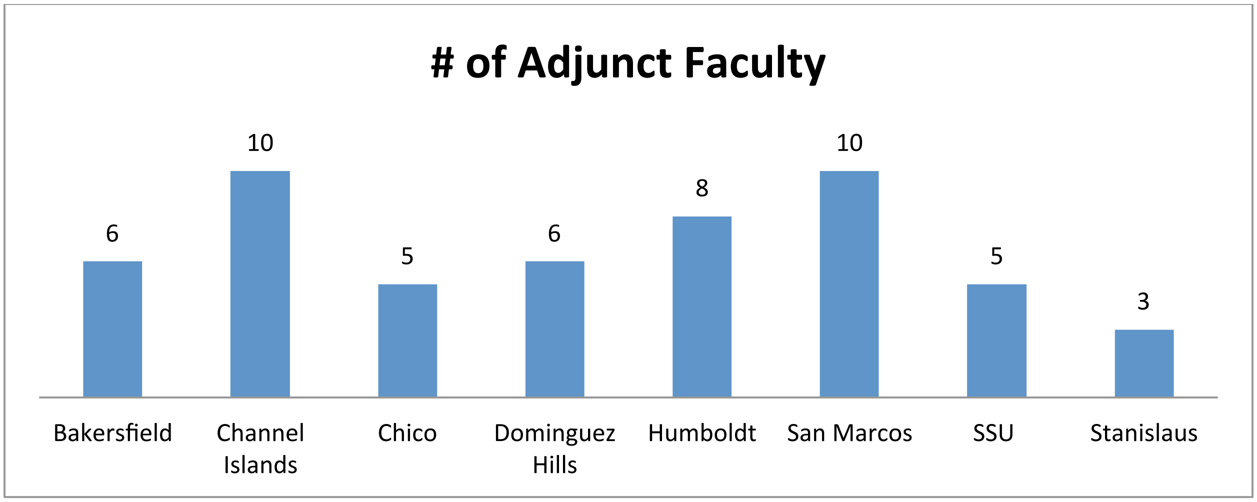
It would appear that 7-8 is the typically amount of faculty for the smaller CSU chemistry departments. In this comparison, it would appear that SSU is in-line with other CSU's



(Figure 2)

Number of adjunct faculty (Figure 3)

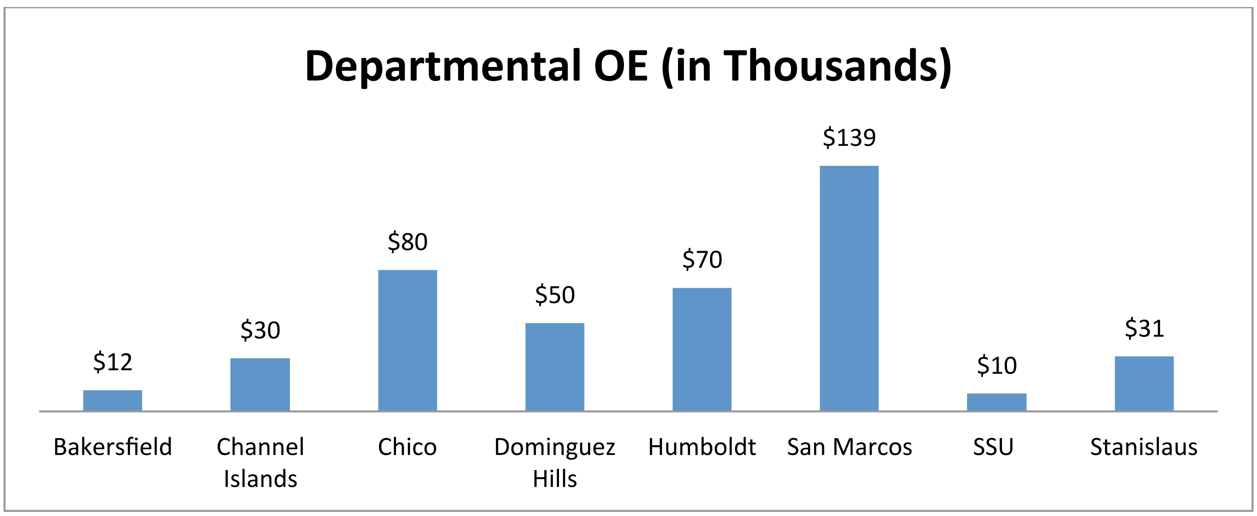
In this comparison it would appear that 6.6 is the average number of adjunct faculty in CSU chemistry departments similar to SSU. Here the SSU chemistry department is slightly less than the average but still within acceptable parameters.



(Figure 3)

Comparison in departmental operating expenses (Figure 4)

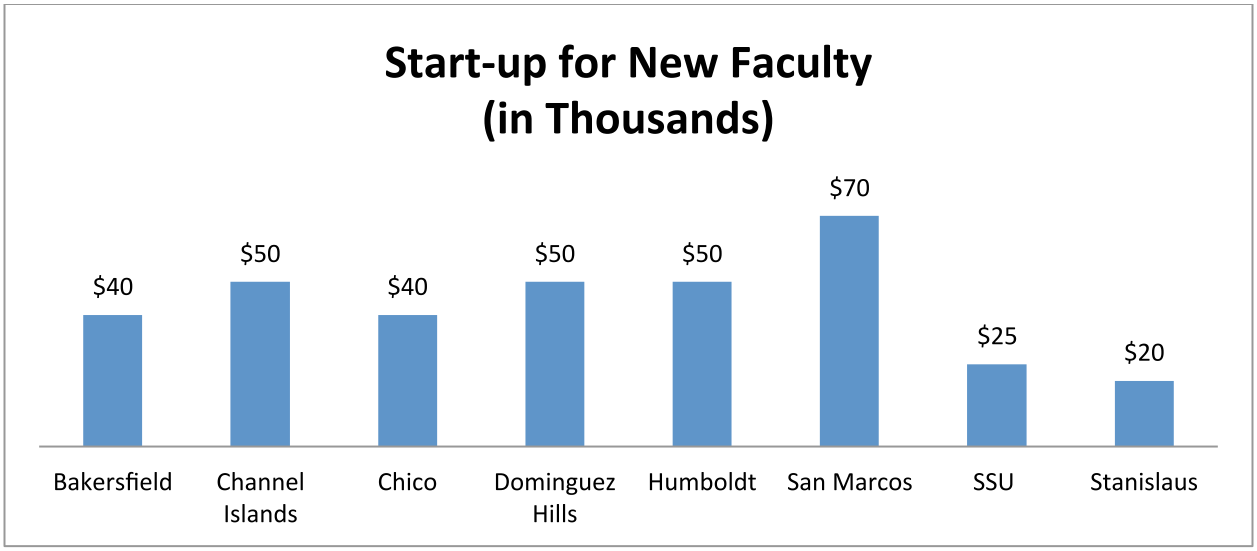
In this comparison, I am very disappointed to point out that the departmental OE given to the SSU chemistry department is at the bottom of the CSU's by a substantial amount. Given that the average OE is $53,000 it is clear that this represents a significant problem.



(Figure 4)

Start-up funds for new tenure track faculty (Figure 5)

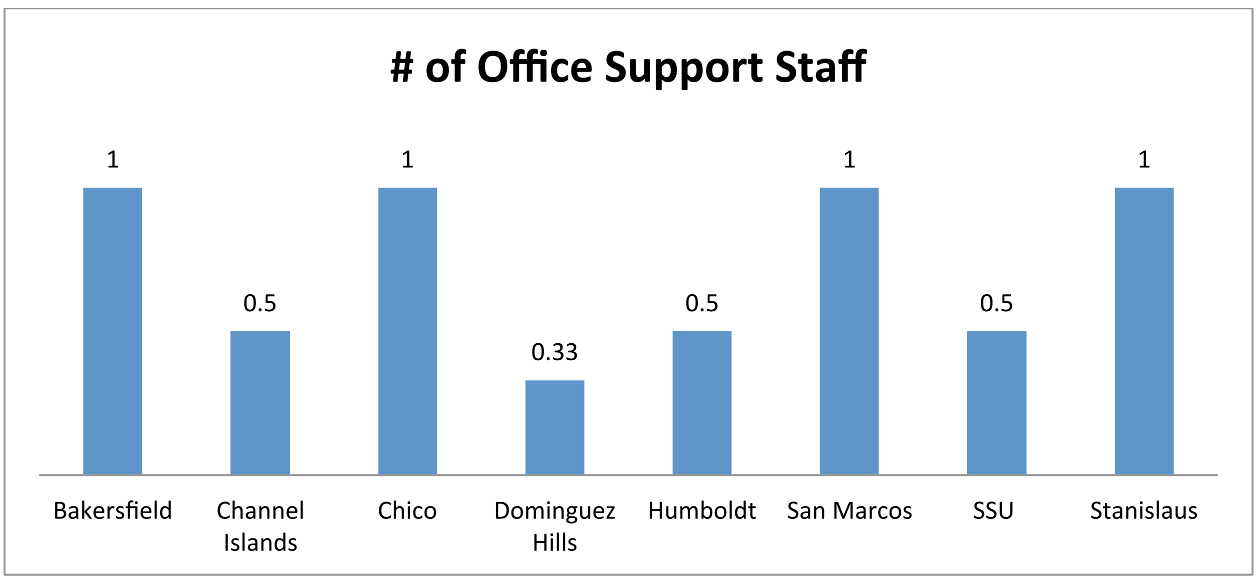
Here again, I am disappointed to report that the start-up funds given to new SSU chemistry faculty is significantly on the bottom of all the compared CSU's. Considering that the average start-up package is $43,000 the SSU chemistry department is out of competition with other CSU's. This may present a problem with recruiting new faculty in the future.



(Figure 5)

Number of office staff (Figure 6)

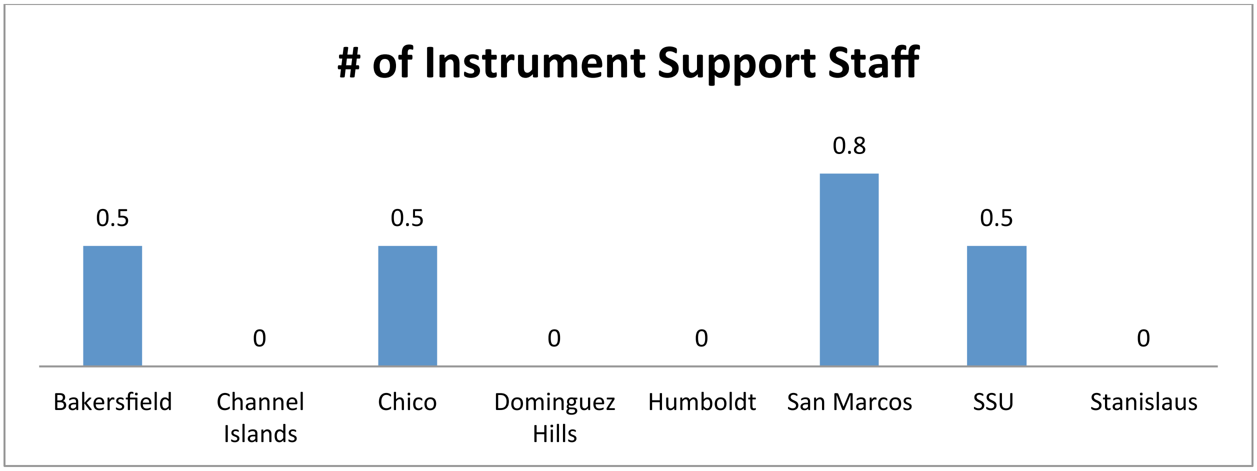
The typical number of office support staff is between 0.5 and 1. Here the SSU chemistry appears to be in-line with other chemistry departments. Apparently, it is common for chemistry departments to share office staff with departments.



(Figure 6)

Instrument support staff (Figure 7)

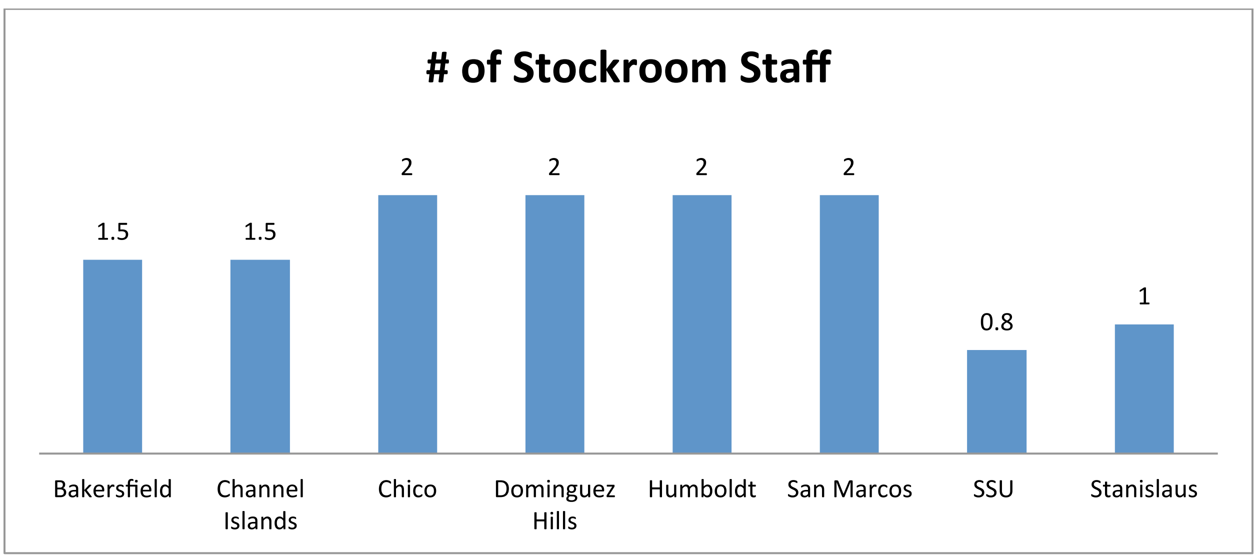
A typical number of instrument support staff is between 0 and 0.5 for chemistry departments of a similar size as SSU's. I would like to point out that these numbers are probably not correct because the chair reporting didn't include instrument support staff shared with other departments or the entire school. I am happy to say that SSU appears to be in-line with other CSU's in this regard.



(Figure 7)

Number of Stockroom Staff (Figure 8)

Once again I am very sad to point out that the SSU chemistry department is at the very bottom of this comparison. The average amount is 1.6 and SSU literally has half that with 0.8. I feel obligated to point out SSU has less stockroom staff than the smallest of the CSU chemistry departments. I feel this represents a significant problem especially considering the fact that many of these chemistry departments do not have an active undergraduate research program like SSU's

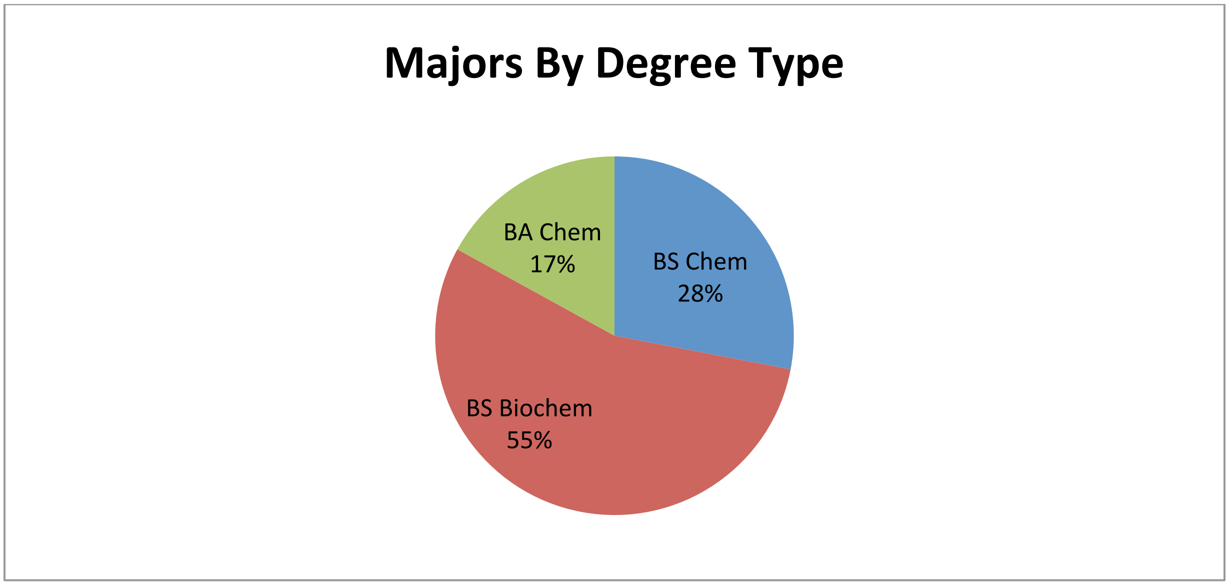


(Figure 8)

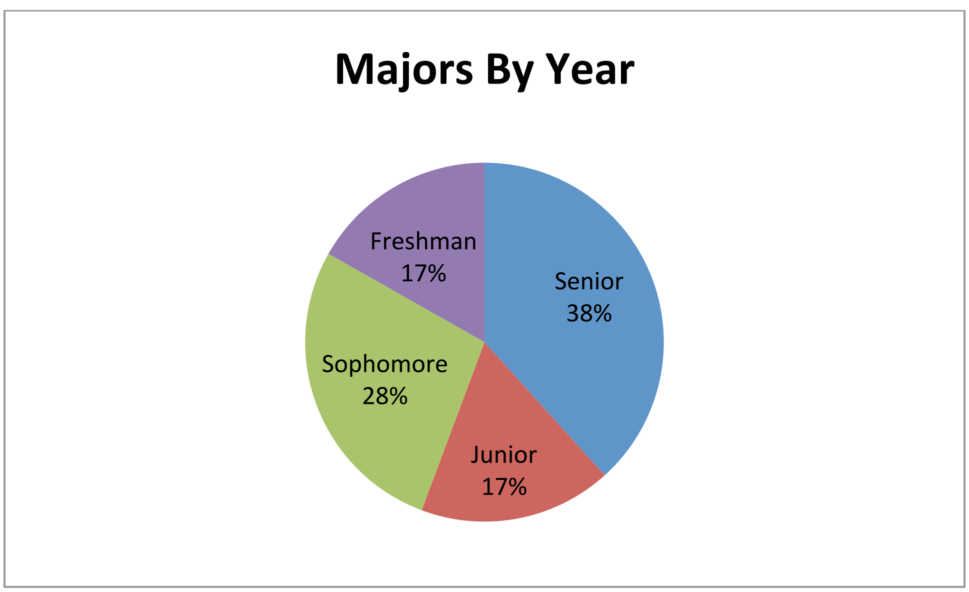
3) Status and trends

A) Student make-up

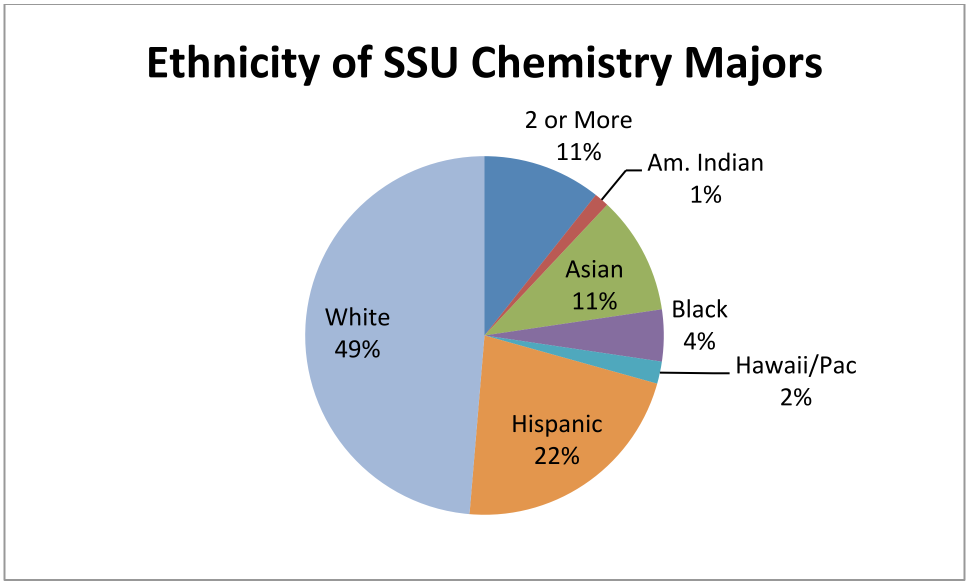
For the 2013/14 school year it was determined that 55% of the current students are biochemistry majors **(Figure 9)**. Roughly 38% of current students are seniors **(Figure 10)** which is in-line with the large number of transfer students and the fact that many students end up taking more than 4 years to graduate. The majority of students (48%) racial designed themselves as white **(Figure 11)** followed by Hispanic (22%) and Asian (11%). The majority of students (31%) have an overall GPA between 2.51 and 3.00 **(Figure 12)**. Only 13% of students had an overall GPA less than 2.0 while 40% of students have an overall GPA higher than 3.01.



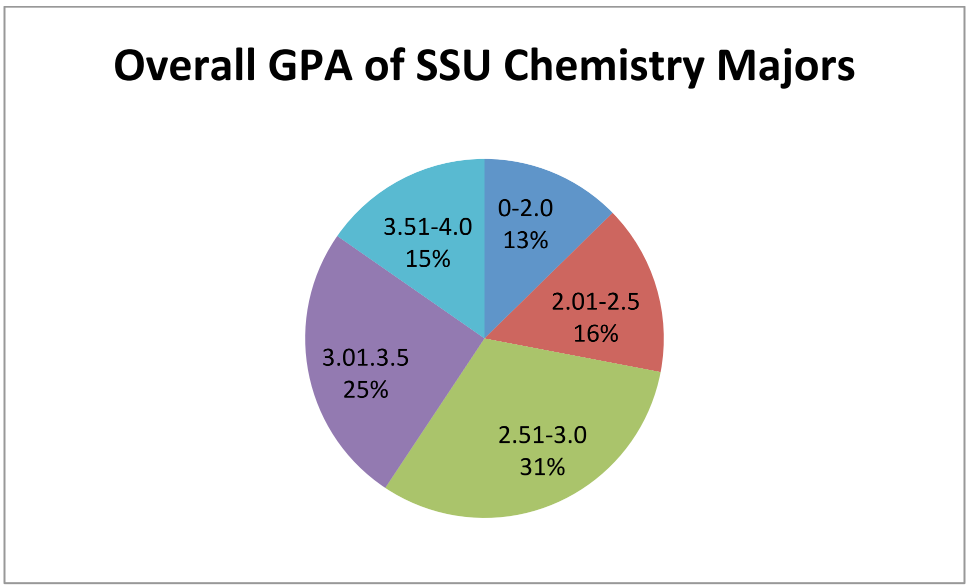
(Figure 9)



(Figure 10)



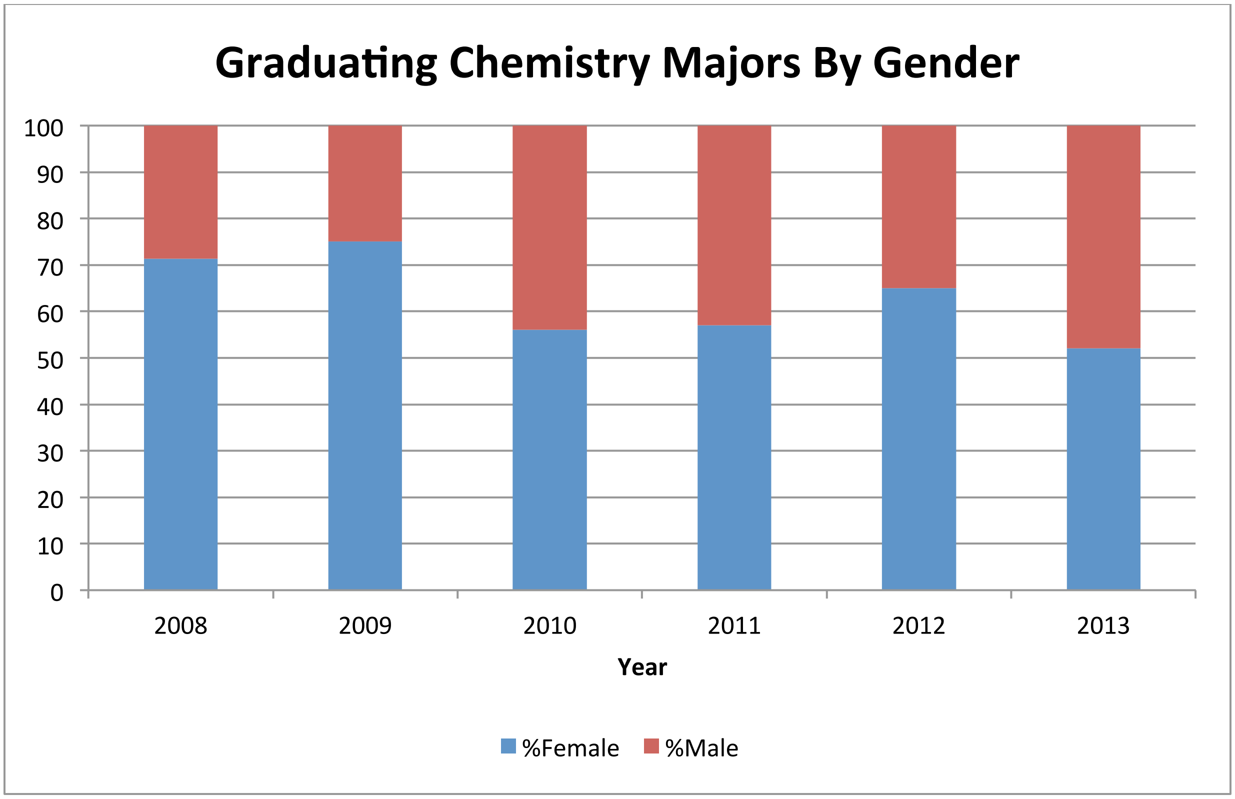
(Figure 11)



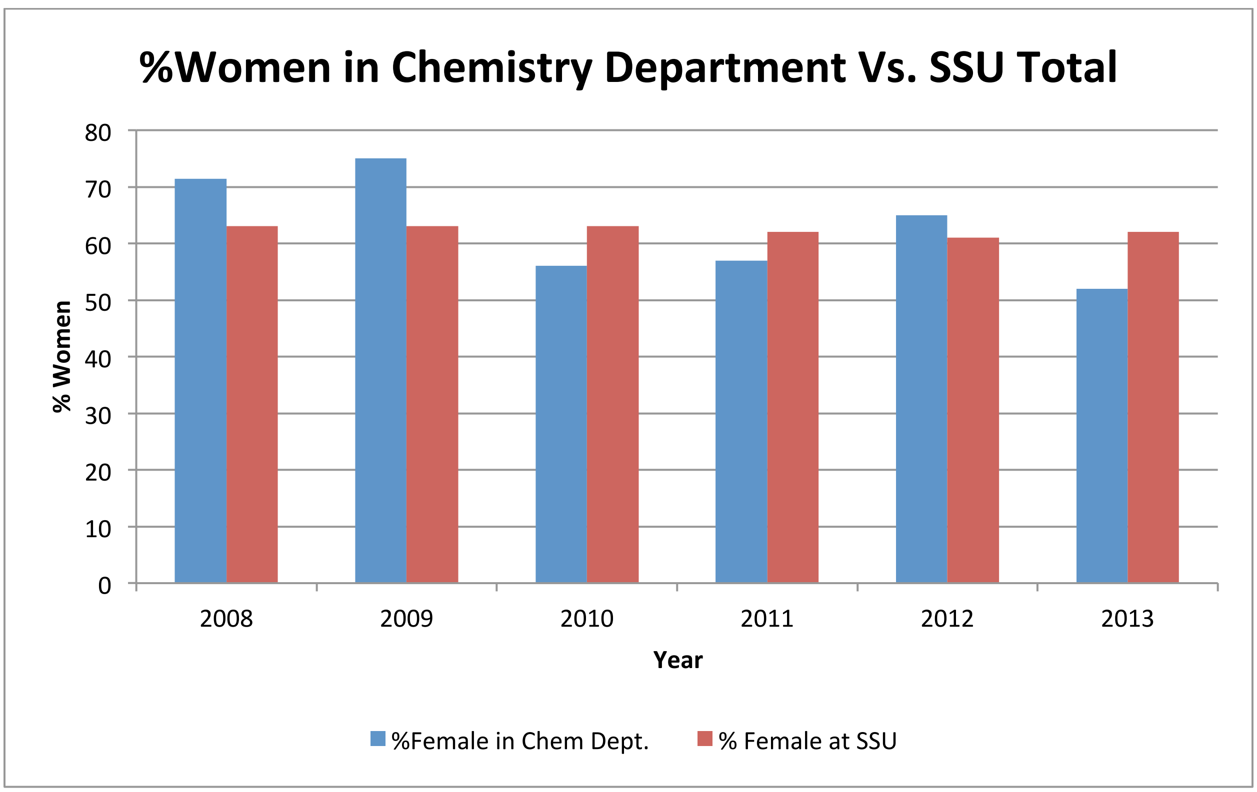
(Figure 12)

B) Student Gender

Over the last five years the chemistry department has maintained a high percentage of female graduating chemistry major with an overall average of 60% **(Figure 13)**. The SSU campus had an overall average female population of 62% **(Figure 14)**.



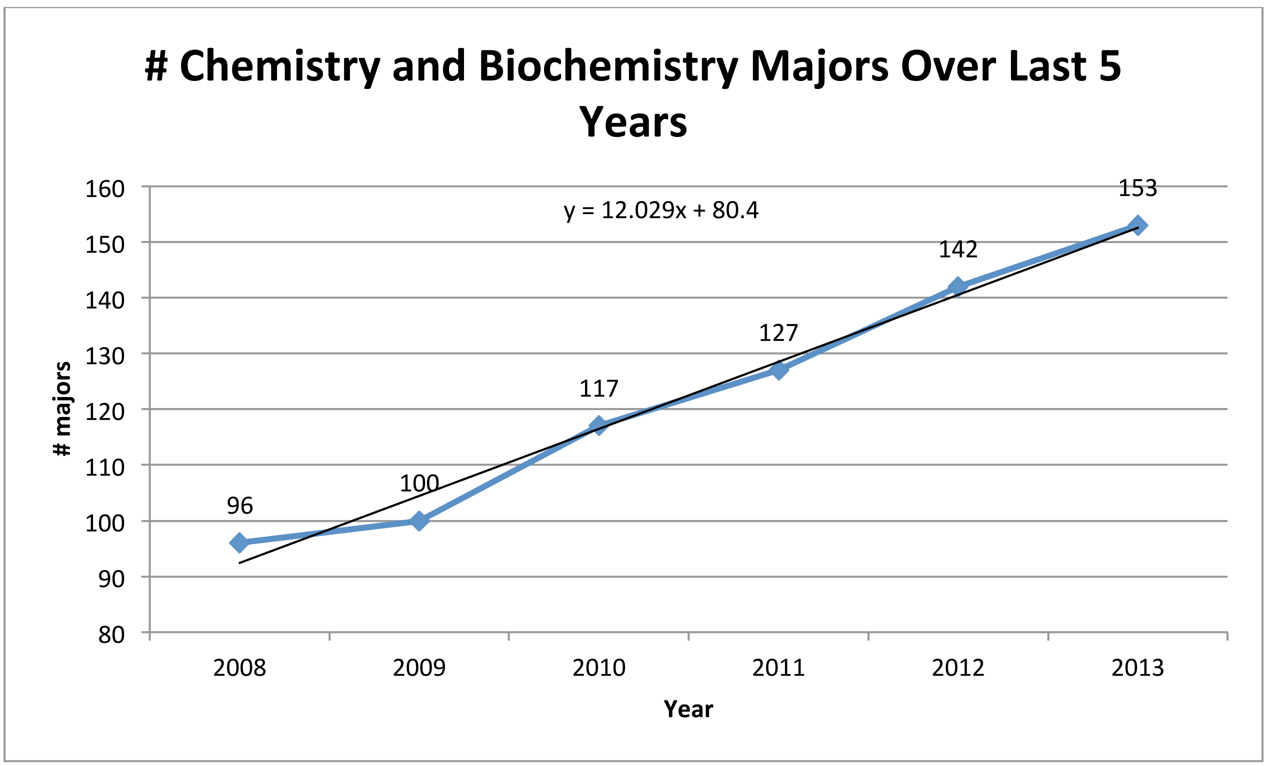
(Figure 13)



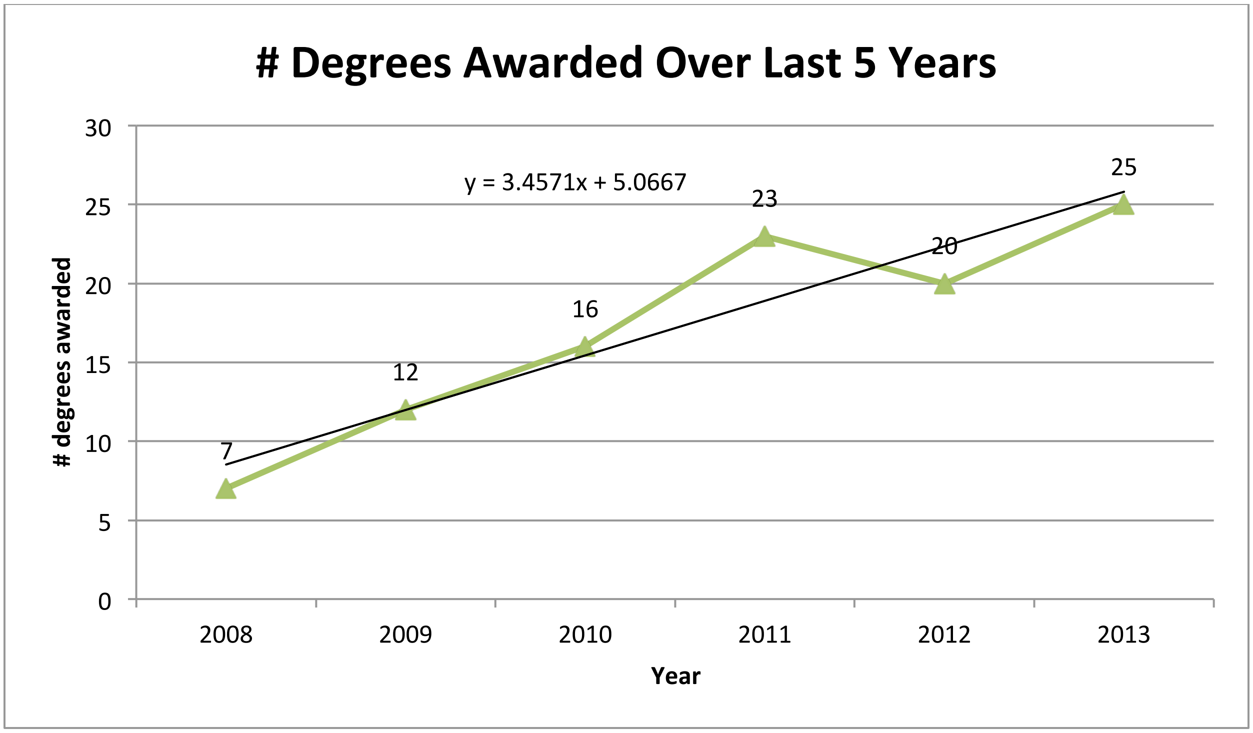
(Figure 14)

C) Growth of the chemistry department

Over the last five years the chemistry department has been undergoing linear growth. This can be clearly seen in the graphs of number of majors and number of graduates per year. On average the total number of chemistry and biochemistry majors has increased by 12 per year **(Figure 15)** and the total number of graduates per year has increased by 3.5 **(Figure 16)**. When looking at the graph showing the percentage of the total number of SSU students who are chemistry majors, it is clear the chemistry department is growing faster than SSU **(Figure 17)**. During the last five years the percentage of SSU students which are chemistry majors has increased from 1.2 to 2.6%. The growth of the SSU chemistry department is fairly unique. When looking at the graphs which compare the growth rates of SSU with eight other similarly sized CSU campuses only CSU Bakersfield was shown to have a similar growth curve **(Figure 18)**. Overall, the fact that the number of majors and graduates from SSU is growing at a rate quicker than the rest of the eight other compared CSU's can be seen when looking at SSU's contribution to the total number of majors and graduates from all CSU's **(Figure 19)**. Over the last five years the percentage of all CSU chemistry majors residing at SSU increased from 2.3 to 3.8% **(Figure 20)** while the percentage of all CSU chemistry and biochemistry majors graduating from SSU increased from 1.5 to 4.4% **(Figure 21)**.



(Figure 15)



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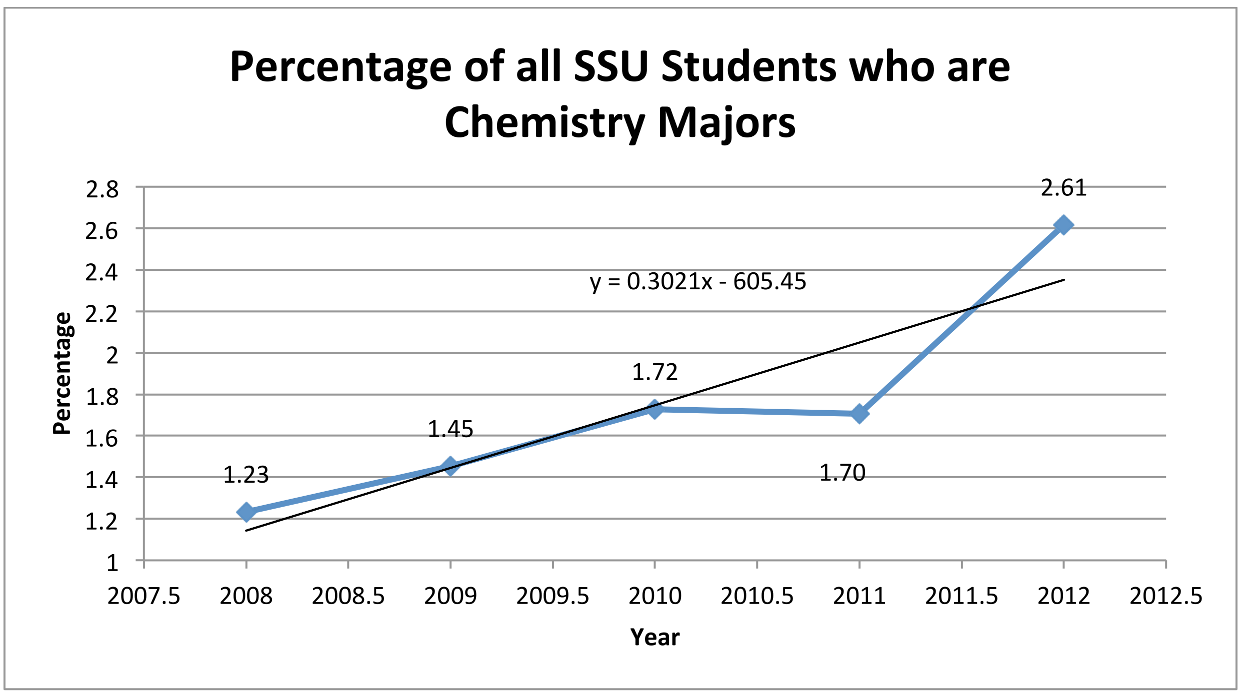
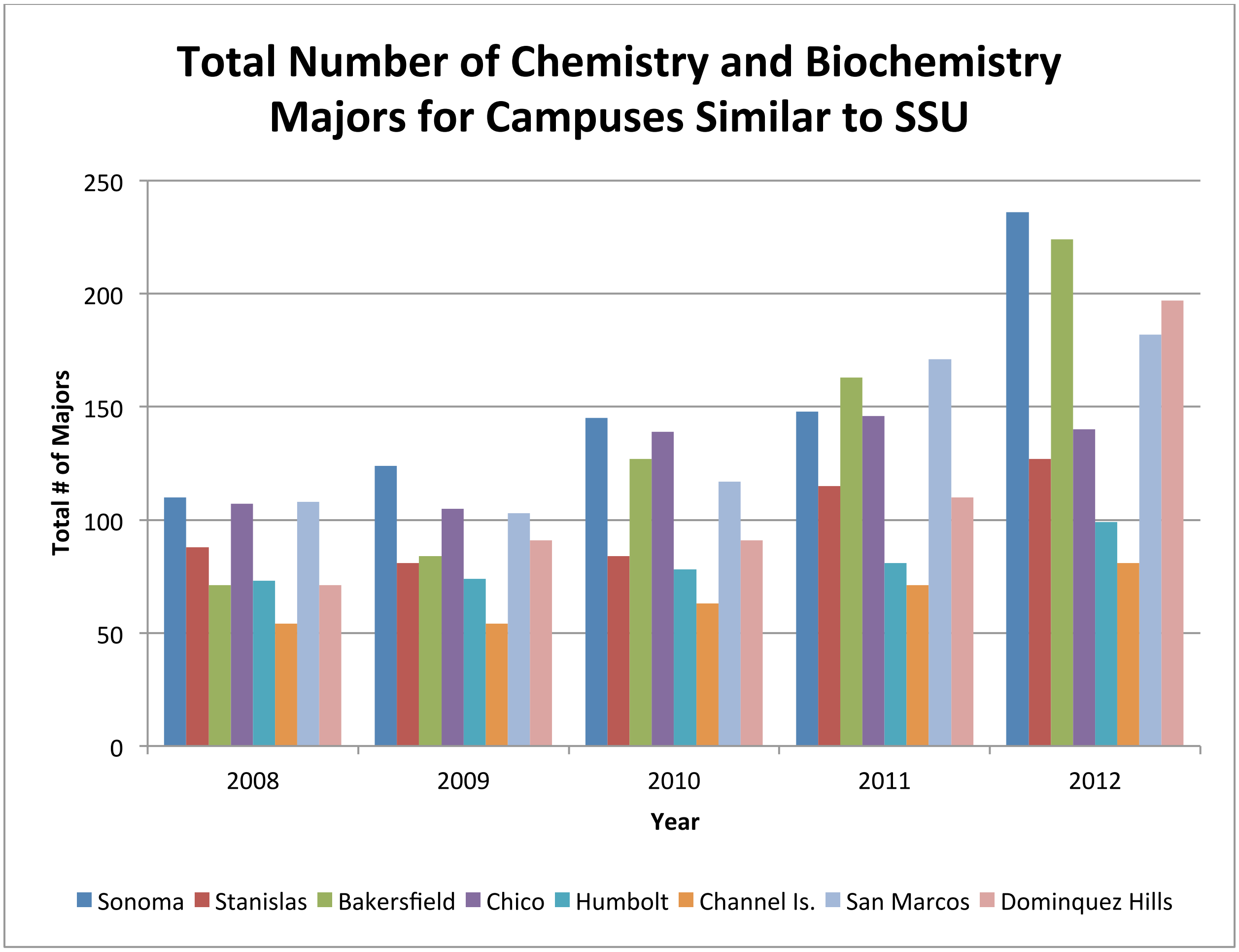
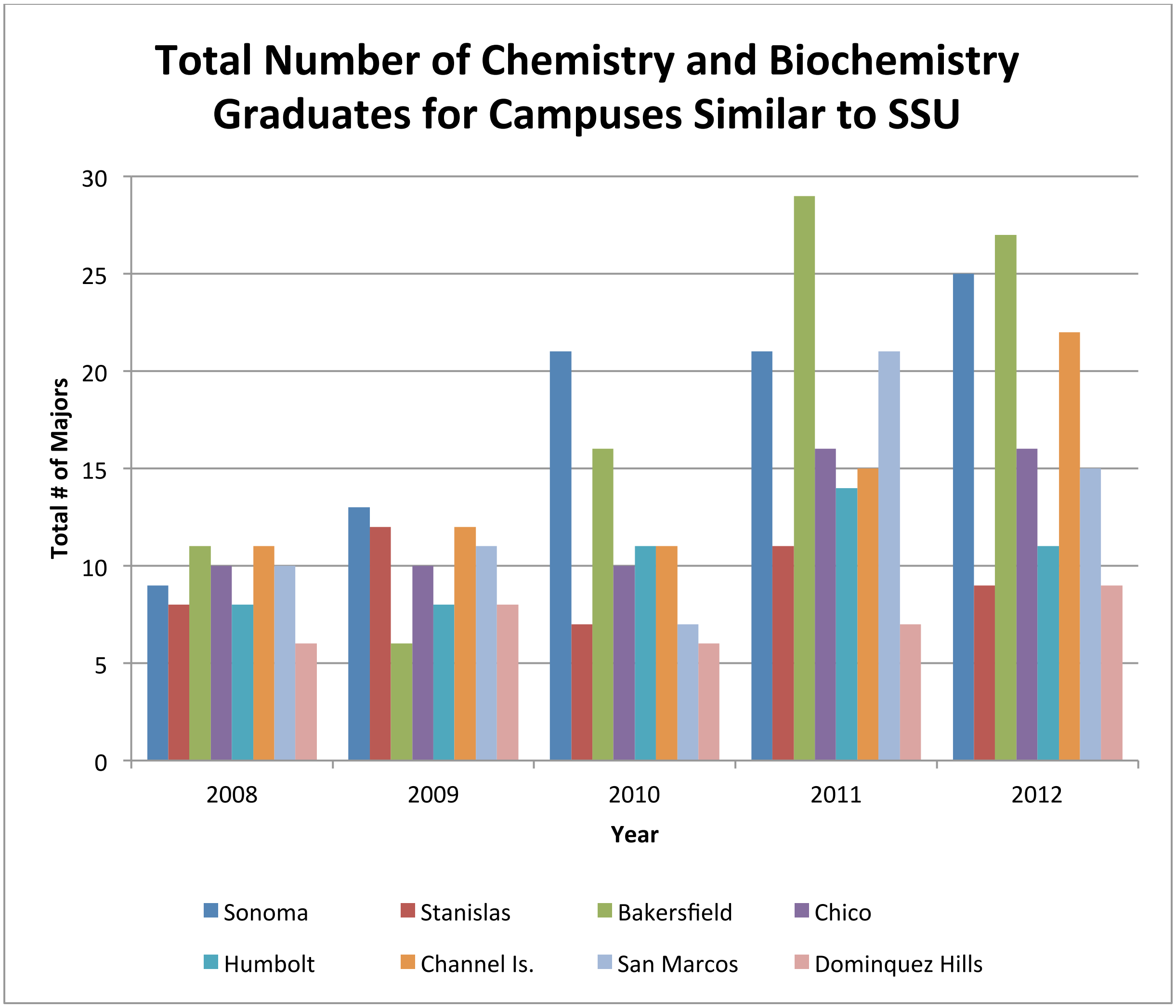


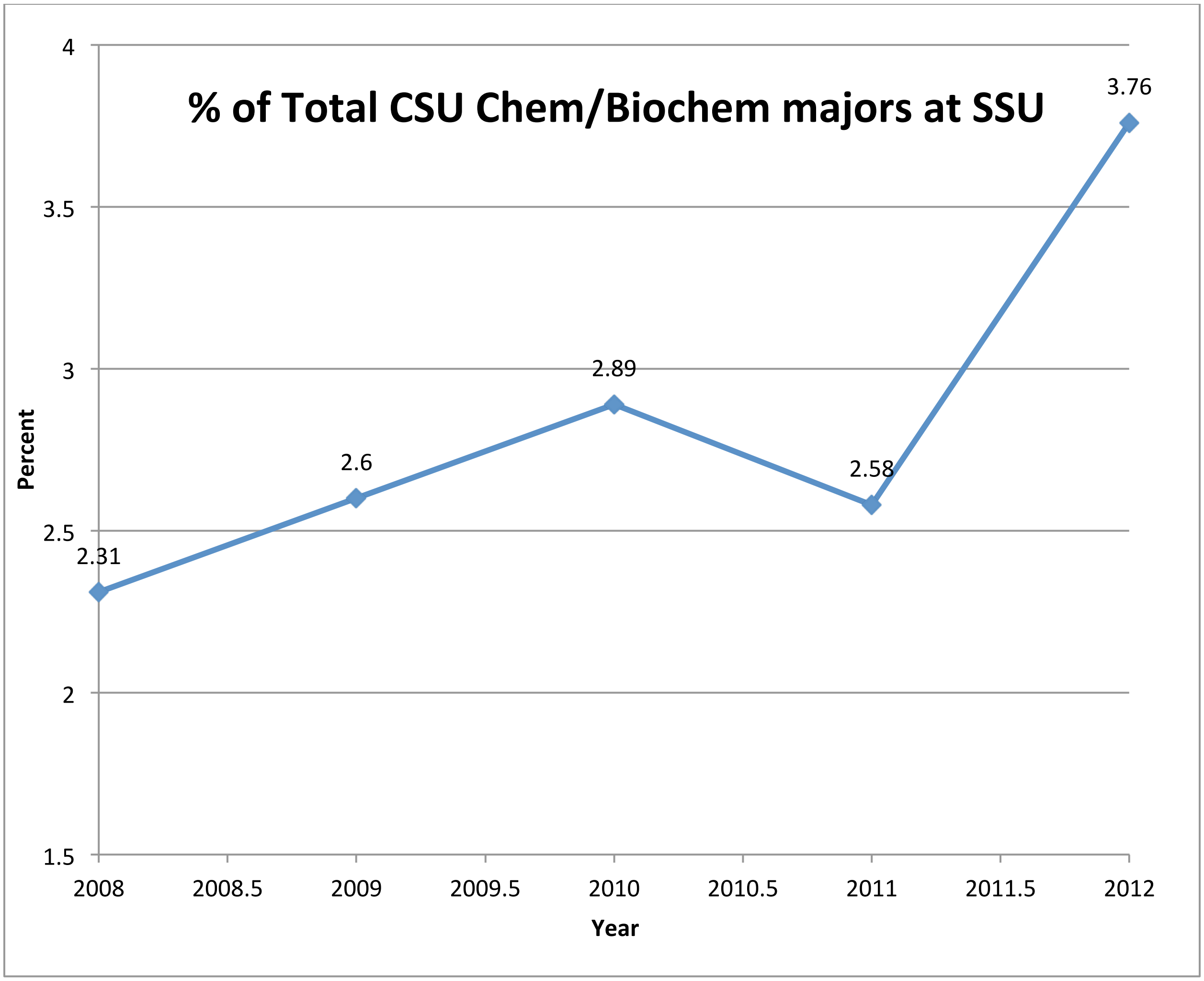
(Figure 17)


Total Number of Chemistry and Biochemistry Majors for Campuses Similar to SSU
250
200
150
100
50
0
Total # of Majors
2008
2009
2010
2011
2012
Year
Sonoma
Stanislas
Bakersfield
Chico
Humbolt
Channel Is.
San Marcos
Dominquez Hills

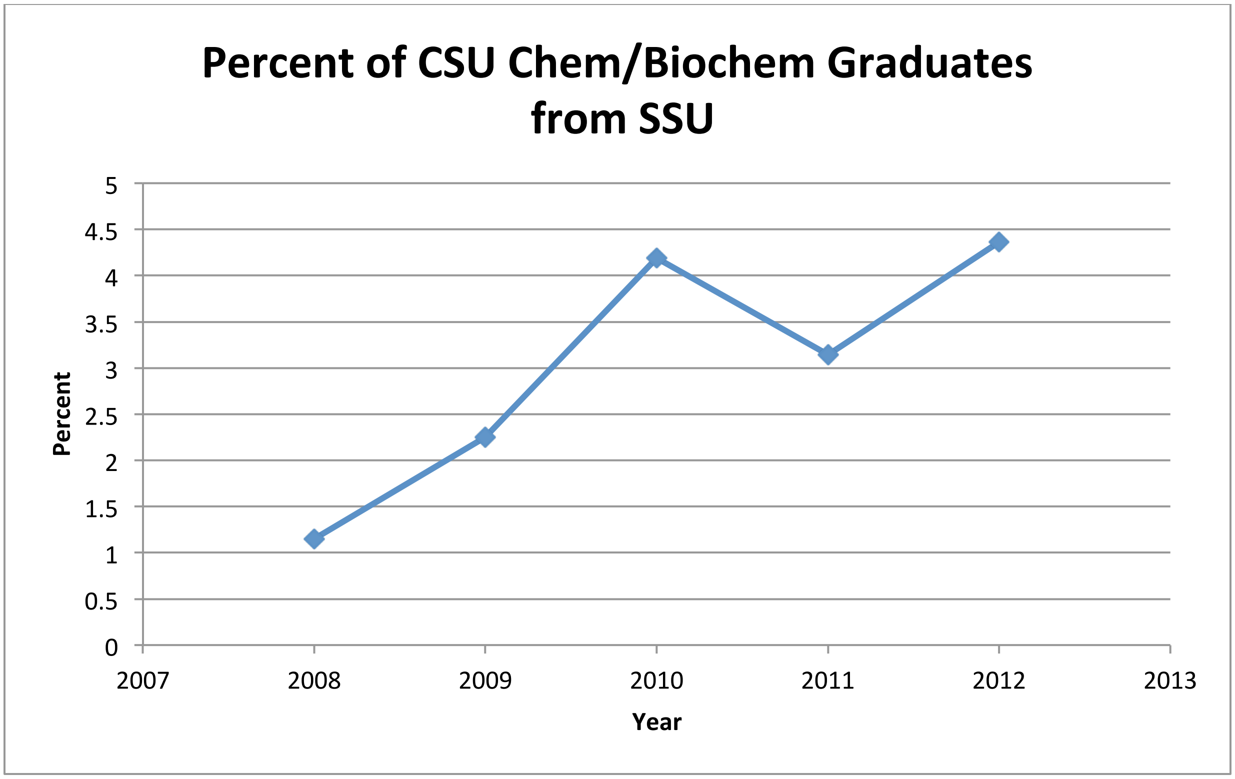
(Figure 18)


Total Number of Chemistry and Biochemistry Graduates for Campuses Similar to SSU
30
25
20
15
10
5
0
Total # of Majors
2008
2009
2010
2011
2012
Year
Sonoma
Stanislas
Bakersfield
Chico
Humbolt
Channel Is.
San Marcos
Dominquez Hills

(Figure 19)


% of Total CSU Chem/Biochem majors at SSU
4
3.5
3
2.5
2
1.5
2008
2008.5
2009
2009.5
2010
2010.5
2011
2011.5
2012
Year
Percent
2.31
2.6
2.89
2.58
3.76

(Figure 20)

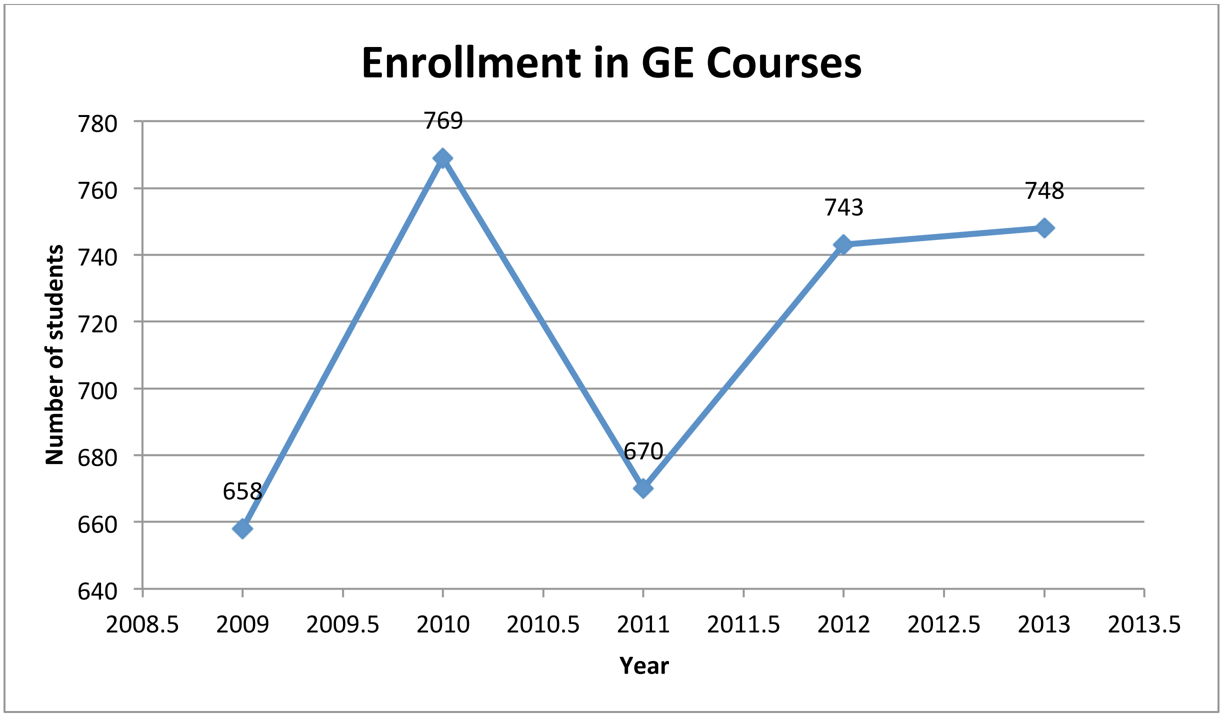


(Figure 21)

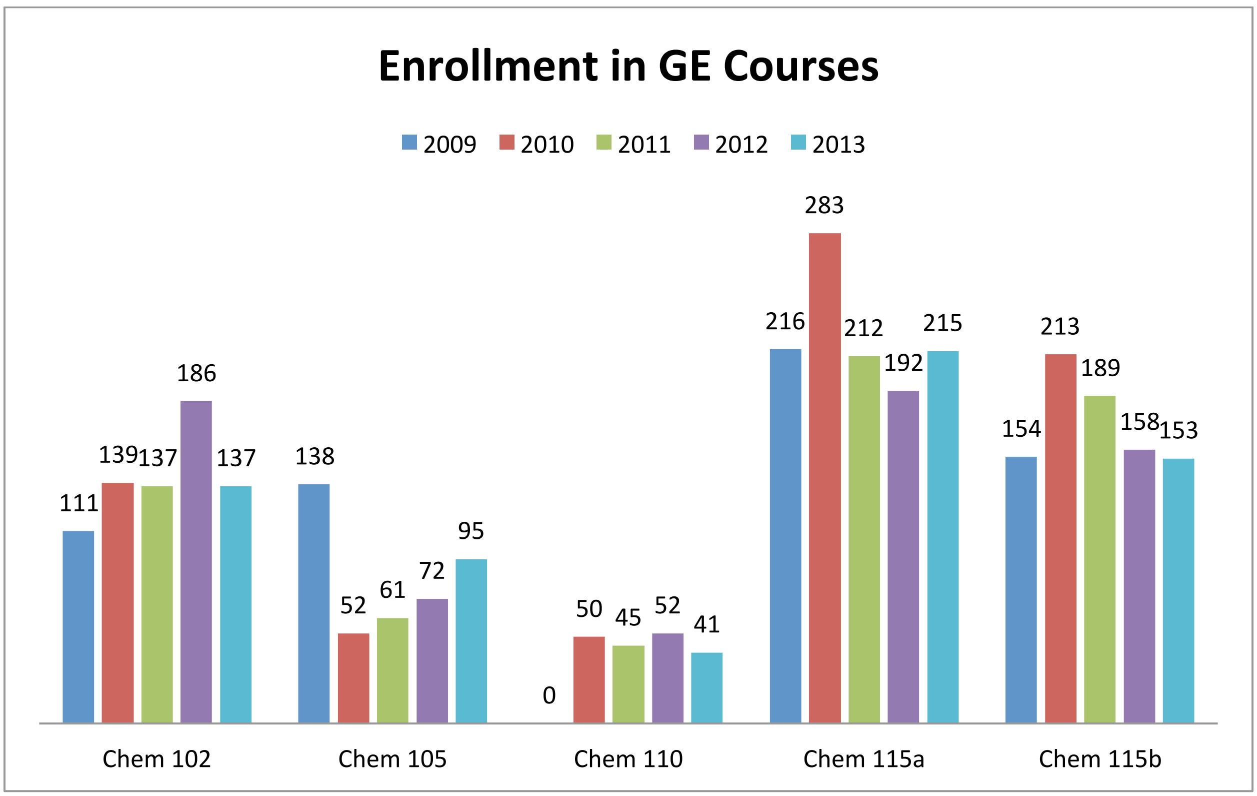
D) Course enrollment

The chemistry department serves the campus by providing a variety of GE courses (Chem 102, 105, 110, 115A, 115B, 120A, 120B, and 125A). As shown in **Figure 22 & 23** the enrollment in these courses has remained relatively constant over the last five years. Likewise, the enrollment in lower division majors courses have remained constant (**Figure 24**). However, the enrollment in upper division majors courses has shown a marked increase starting at 2011. This corresponds to the increased number of majors along with the addition of new upper division chemistry courses, such as Chem 315, 315, and 496. A closer inspection of upper division courses showed that organic chemistry lectures (335A & B) has remained fairly constant over the last five years (**Figure 25**). When looking at the corresponding organic chemistry labs Chem 336B shows a fairly steady enrollment over the last five years. However, Chem 336A shows a marked decrease in enrollment since 2011 (**Figure 26**).

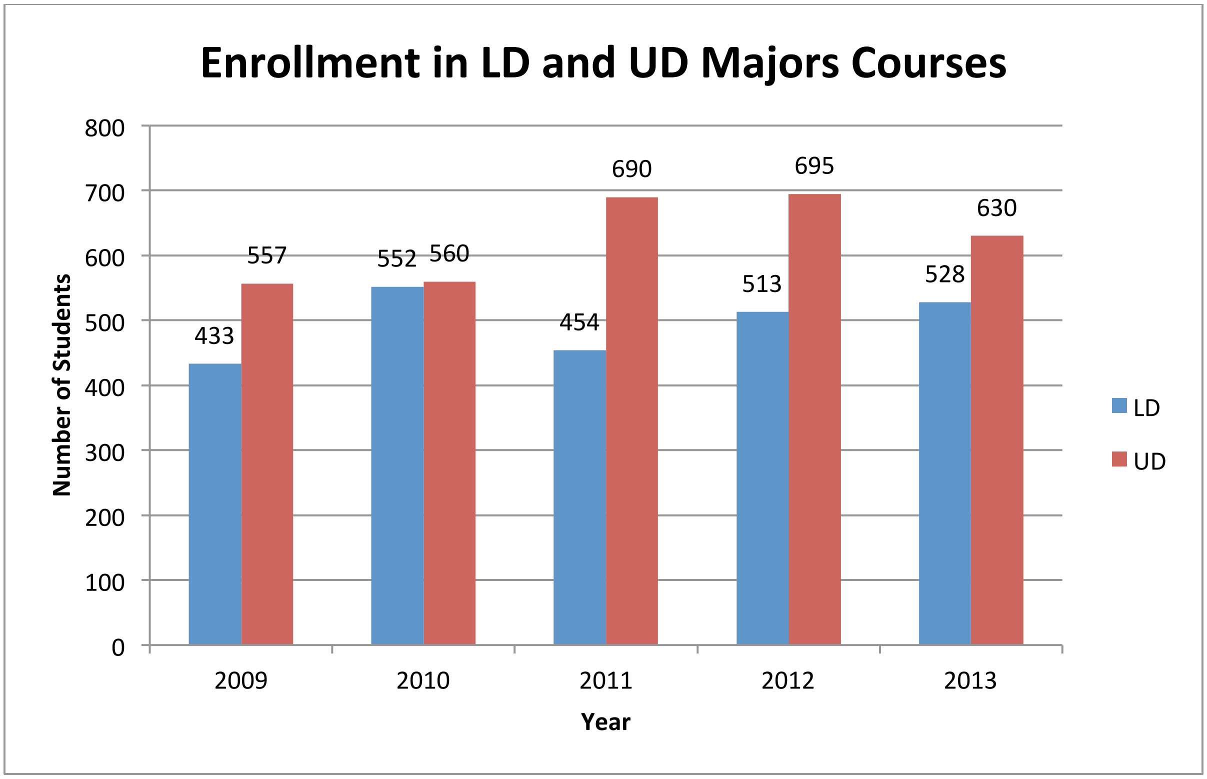
In general the FTES of the chemistry department has steadily increased over the last 10 years from 128 to 183 (**Figure 27**). However, the FTES has remained fairly constant since 2009 only increasing from 172 to 183. This fact is mirrored by the FTES of GE courses (**Figure 28**) and the lower and upper division majors courses (**Figure 29**) since 2009.



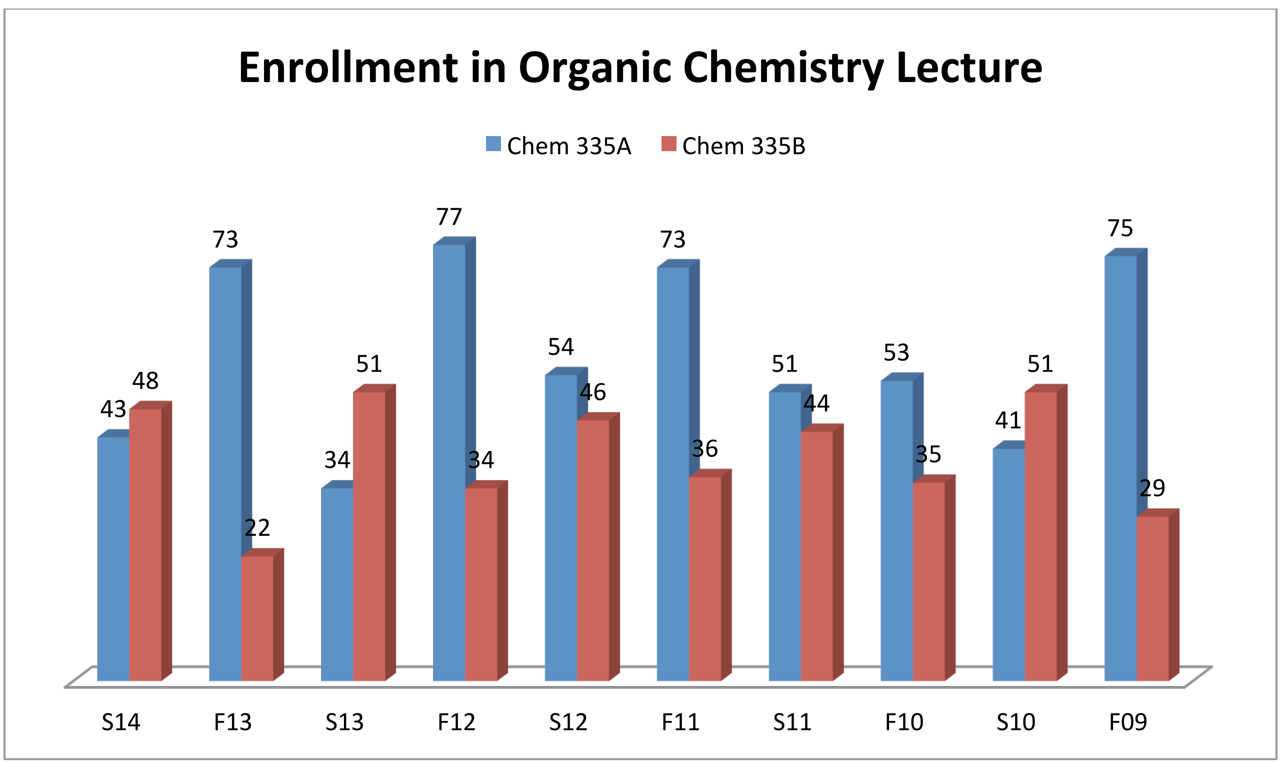
(Figure 22)



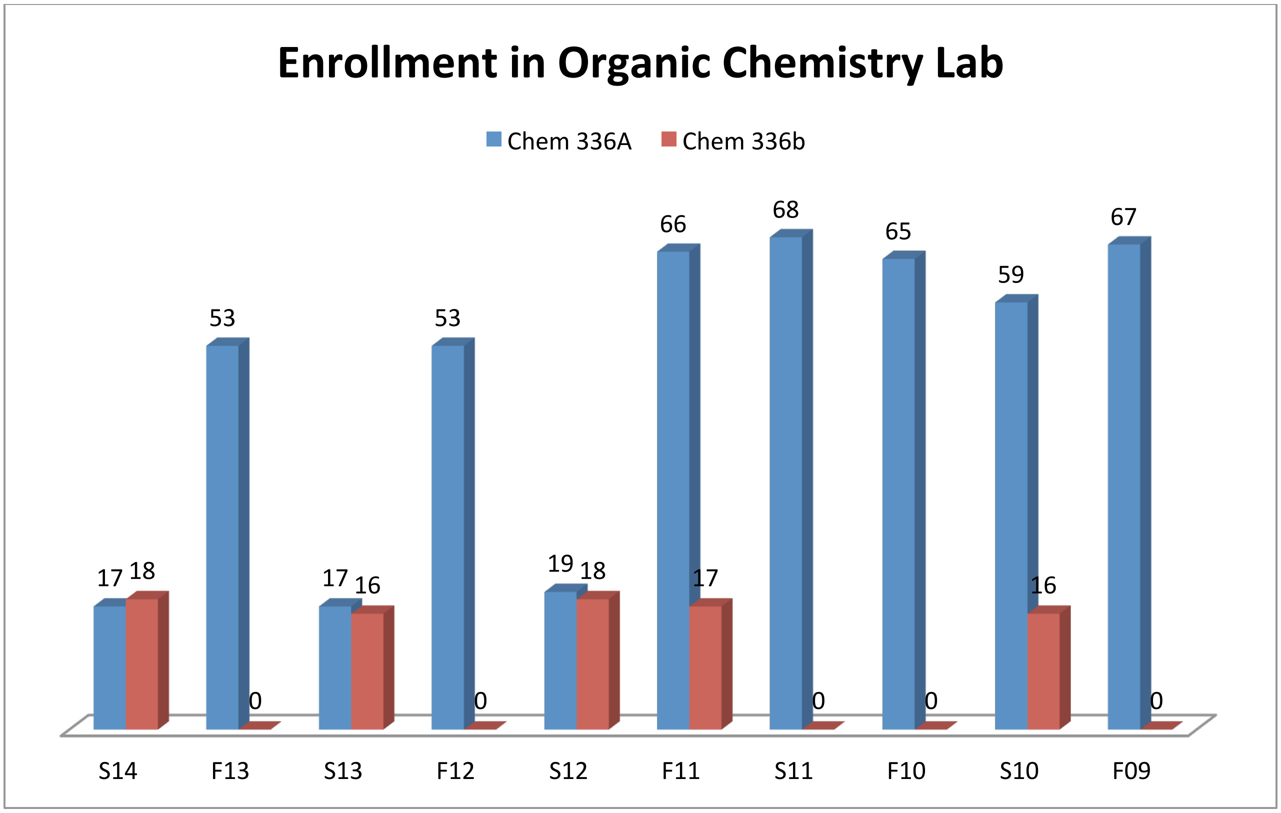
(Figure 23)



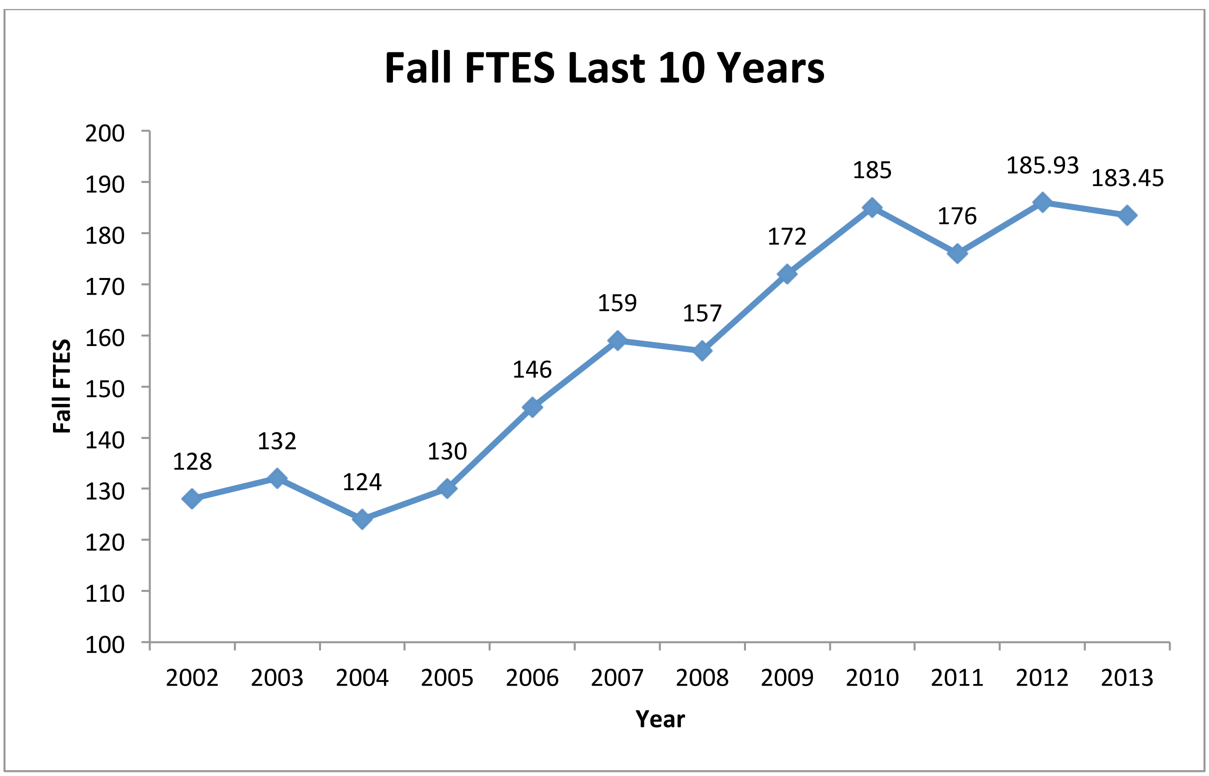
(Figure 24)



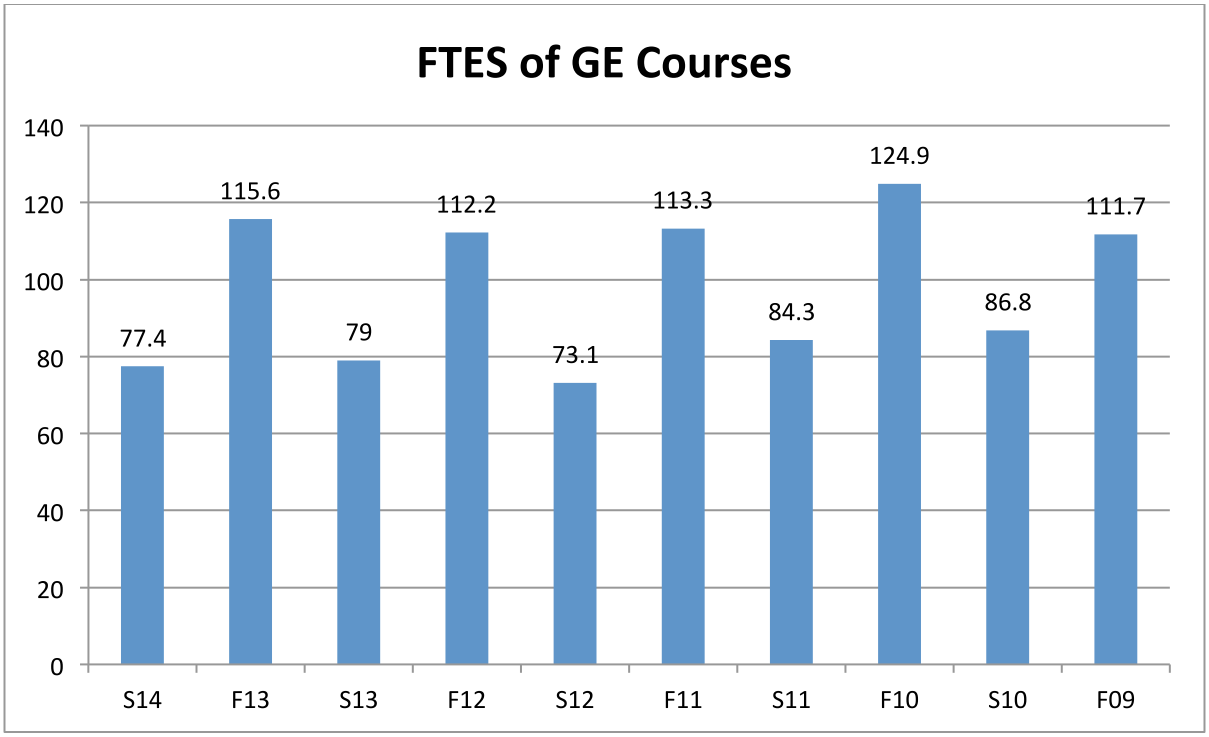
(Figure 25)



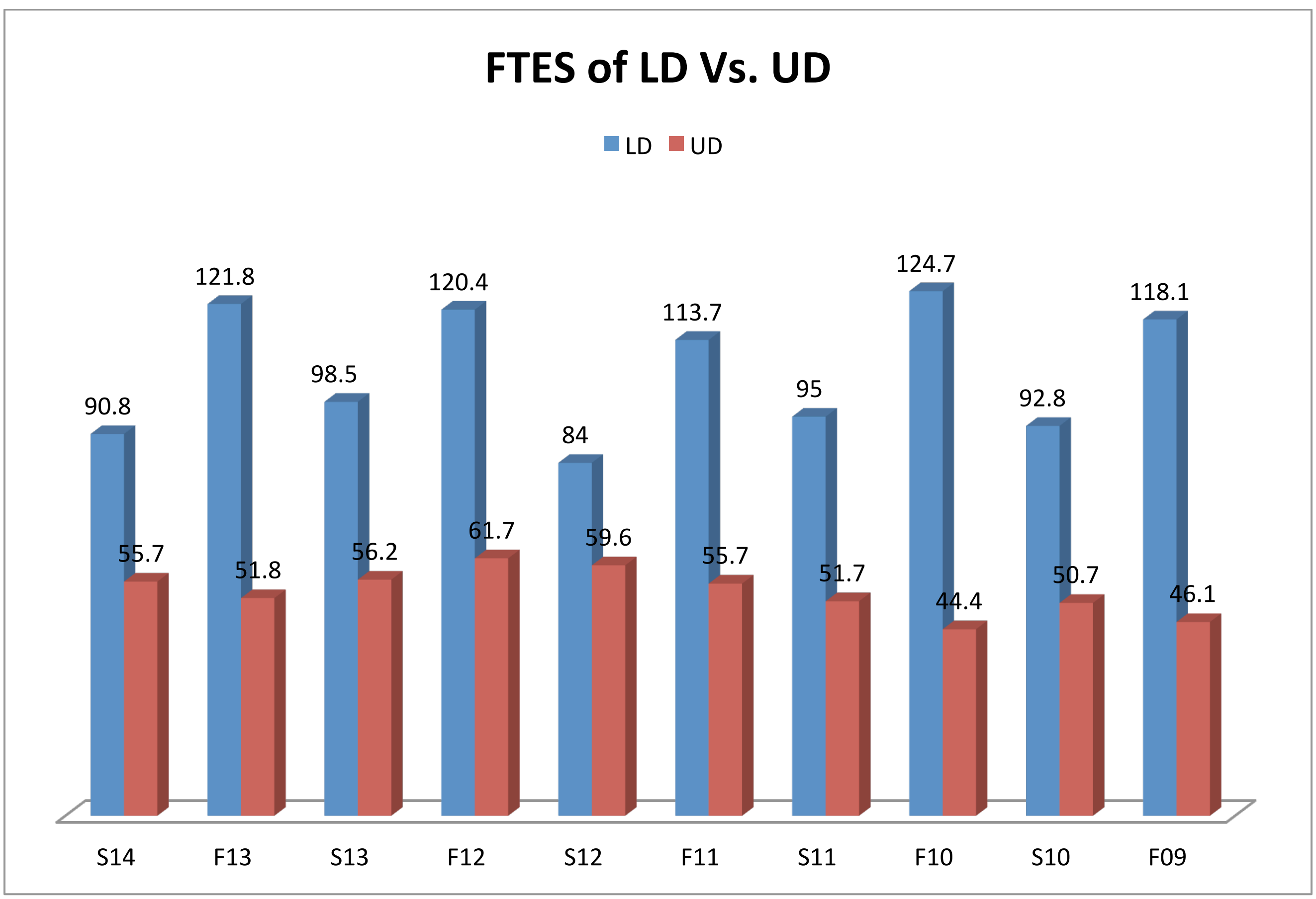
(Figure 26)



(Figure 27)



(Figure 28)



(Figure 29)

4) Assessment

A) Exit exam

We were curious as to how our graduating seniors would perform on a cumulative chemistry exam and decided that an Exit Exam might be useful as part of the Department Exit Procedure in conjunction with our exit survey and public seminar. We decided the exam should be descriptive, easy to grade, and easy to implement so we designed a 20 question multiple choice exam with two questions related to each of our first 9 learning outcomes which are chemical knowledge based. A copy of the exit exam can be found in **Appendix E**. We administered the exam to 21 students in 2011 as part of the senior seminar course. Our original goal was that 2/3 of students would score above 65%. Analysis of the exit exam results indicated that at this time 43% of the students scored above 65% and the distribution of scores overall was quite broad. Interestingly, students that scored above 65% overwhelmingly had strong participation in undergraduate research and presented the results of their research at a scientific conference. All of the students that took the exam and went on pursue a Ph.D. scored above a 65%. It is not possible to conclude from this data if students that retain more chemistry knowledge gravitate towards research or if participating in undergraduate research strengthens their retention of information. We intend to do a more itemized analysis of the questions to see if we can extract any other information on which learning objectives are met the strongest and which we may need to improve upon as well as discuss the meaning of the results to our program as a whole.

The exam was given again in 2012 to 20 students. In total 9 students (45%) scored higher than 65% on the exam.

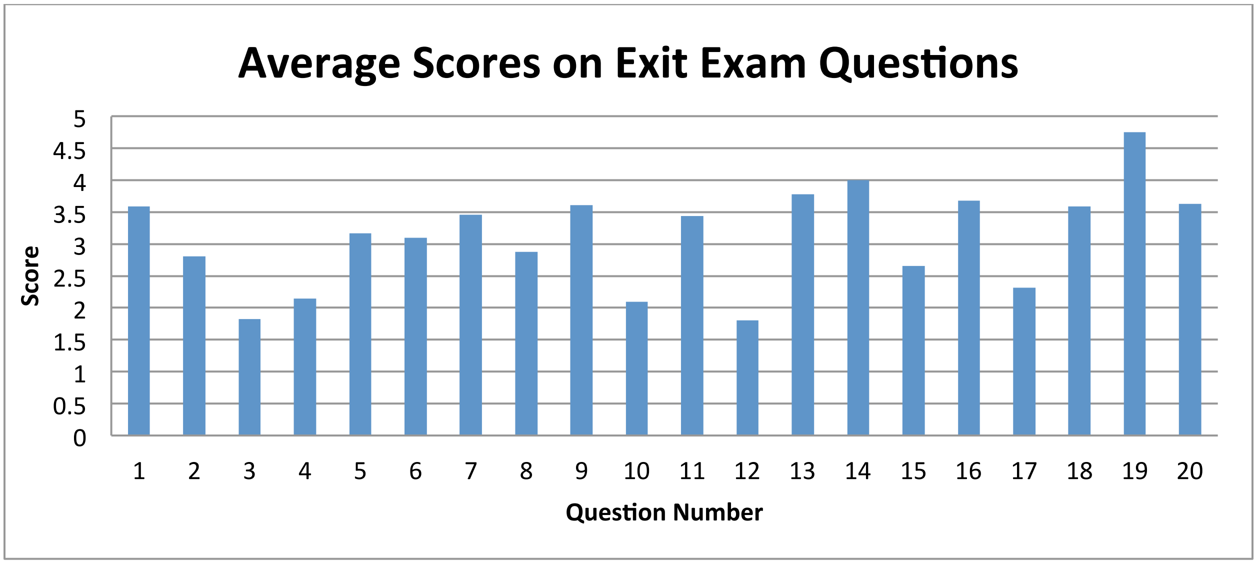
Combining the results from both exam results show that the average student score was 62.3% **(Figure 30)**. When looking at individual questions the highest average score was a 4.76 on question 19. The lowest average score was 1.83 on question 3 **(Figure 31).**

.

A) Learning outcomes for the overall program

1) Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)
2) Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).
3) Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),
4) Understand the concepts of acids and bases, neutralization and buffers
5) Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.
6) Data manipulation and interpretation
7) Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design.
8) Working skills and knowledge in instrumentation and computer literacy
9) Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.
10) Reading and interpretation of chemical literature and communication skills (oral and written)
11) Ability to implement career planning

The bulk of these learning outcomes were assessed by the students' scores on their exit exam. The exam was designed such that certain questions would assess each of these learning outcomes.



(Figure 30)

Learning outcome	Assessment questions	Raw Scores on exit exam	Average Scores on Exit Exam
1	3, 12	1.8, 1.8	1.8
2	6, 18	3.1, 3.6	3.35
3	4, 17	2.1, 2.3	2.2
4	1, 5, 16	3.6, 3.2, 3.7	3.5
5	8, 13, 20	2.9, 3.8, 3.6	3.4
6	7, 10, 19	3.5, 2.1, 4.8	3.7
7	11, 15	3.4, 2.7	3.05
8	2	2.8	2.8
9	9, 14	3.6, 4.0	3.8

(Figure 31)

Learning outcomes which are being strongly met (Score >3.3)

2) Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).
4) Understand the concepts of acids and bases, neutralization and buffers
5) Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.
6) Data manipulation and interpretation
9) Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.

Learning outcomes which are marginally being met (Score 2.8-3.3)

7) Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design
8) Working skills and knowledge in instrumentation and computer literacy

Learning outcome which strongly not being met (Score <2.8)

1) Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)
3) Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),

Learning outcome 10 "Reading and interpretation of chemical literature and communication skills (oral and written)"

All chemistry lab courses past general chemistry require detailed, type-written lab reports for each experiment preformed. In addition, students in chem 401 are required to give a 50 minute oral presentation on a topic related to the course, students in the Chem 315/316 series are required to write a project proposal, a project summary, and give a 20 minute seminar regarding their research project. Students in Chem 497 are required to give 20 minute seminar to the department. Students in Chem 441 and 402 are required to give a project proposal defense. Also, students in Chem 315, 402, & 441 are generally required to give a poster presentation. Even more so, the students have been active in presenting work at conferences. In total **104** presentations have been made by Chemistry students since the last program review. A complete list can be found in **Appendix F.**

Learning outcome 11 "Ability to implement career planning"

Year	Total # Graduates	# Employed in industry	%	# Going to health profession	%	# Going to graduate school	%	Total	%
2008	7	3	42.85714	1	14.28571	1	14.28571	5	71.42857
2009	12	3	25	3	12	6	50	12	100
2010	16	8	50	4	8	2	12.5	14	87.5
2011	22	12	54.54545	3	5.5	6	27.27273	21	95.45455
2012	20	10	50	2	4	5	25	17	85
Total	**77**	**36**	**46.75325**	**13**	**27.80556**	**20**	**25.97403**	**69**	**89.61039**

(Figure 32)

As shown in the table the graduates from the SSU chemistry department for the last five years have had a very high rate of success. In total roughly 90% of the graduates have either gained admission to some form of post-graduate program or obtained a position in the industry **(Figure 32)**. Most of the remaining 10% have lost contact with department with very few having been confirmed not to have obtained a position which involves their undergraduate degree.

Overall assessment of departmental learning outcomes

Based on the assessment methods available the chemistry department has been doing phenomenally well.

Only learning outcomes 1 & 3 were found to be lacking. It should be noted that the material covered in these learning outcomes is generally cover in general chemistry. A significant number of our graduating majors do not take general chemistry at SSU.

B) Graduate placement exam scores

As a method to assess the overall preparedness of students who enter graduate programs be began to record their scores on any placement exams they may take upon entering graduate school **(Figure 33)**.

Student	Organic	Inorganic	Physical	Analytical	Biochemistry
Andrew Davidson	38%	49%	78%	69%	55%
Jennie Pomponio	46/70 (above 50% nationally)	37/60 (above 50% nationally)	38/60 (above 50% nationally)	29/50 (above 50% nationally)	37/60 (above 50% nationally)
Kaitlin Fisher	Pass	Pass	Pass	No pass	Pass
Leah Knight	39%	66%	25%	52%	20%
Daniel Pritchard	39/70 (40 to pass)	26/70 (32 to pass)	24/60 (32 to pass)	30/60 (32 to pas)	11/60 (26 o pass)

(Figure 33)

Some problems were quickly noticed on effectiveness of these scores as a method of program assessment. 1) Not all students took organic chemistry at SSU 2) Students reported in national percentages, a raw score, or pass/no pass = difficult for comparison since not always sure which version of the exam they took 3) Students took either 1 or 2 semesters of biochemistry; the exam is cumulative 4) A large amount of how students do on these exams depends on how much preparation they do in the summer prior to admission to the graduate program. Because of these problems we stopped tracking these scores and will revisit the utility of these scores during the next departmental retreat.

C) SI Evaluations

The tutorial center performs student evaluations for chemistry SI's each semester. The results from Fall 2013 are located in **Appendix G**. In all cases the chemistry SI's received many excellent written comments and their numerical scores were mostly 5's (Strongly Agree) for the questions which evaluate their helpfulness.

D) Department SETEs

In fall 2013 the cumulative SETE scores for the whole department were acquired. In total 854 evaluations were obtained coming from every chemistry course at SSU. For every question the chemistry faculty was scored between 4.00 and 4.50 on a scale of 1-5 with 4 being effective and 5 being very effective. The lowest score for the department was 4.07 seen on the question “My instructor makes difficult topics understandable.” The highest was a 4.43 and was seen in the question “My instructor displays competence in course topics.” Copies of the departmental SETE’s can be found in **Appendix H**.

E) Participated in the GE B1 assessment process

Faculty teaching in GE B1 courses (CHEM 102, CHEM 105, CHEM 110, CHEM 115A, CHEM 115B, CHEM 125A) used the rubric provided by the GE subcommittee and an assessment tool of their own choosing to assess if their students were achieve the GE B1 Learning Objective: *Understand the physical world through interpretation of results from experimentation and/or observation.* Chemistry faculty chose to use embedded questions in their regular exams that represented the learning objectives and then assigned a % correct required for each portion of the assessment rubric (Not Meeting, Approaching, Meeting, Exceeding). On average, students in these classes were found primarily to be meeting the learning objective. The Chemistry Chair represented the department at the follow-up meeting of these assessment results with the GE Subcommittee. During this meeting we noted that some of the instructors utilized their entire exam as the assessment tool rather than picking questions off of the exam that were specifically geared toward the learning objective being assessed and we plan to make sure we are more clear on how to select appropriate embedded questions in the future.

F) Results from ACS Exams

To access our general chemistry program we administered the American Chemical Society Standardized Exam for Year-Long General Chemistry Sequence in Chemistry 115B (2002 Brief Exam), 2nd Semester General Chemistry

Spring 2010 (Dr. Meng-Chih, Su) 25/50
Fall 2010 (Dr. Steven Farmer) 24/50
Spring 2011 (Dr. Meng-Chih, Su) 24/50
Fall 2010 (Dr. Steven Farmer) 24/50
Spring 2013 (Dr. Steven Farmer) 23/50

Given that a score of 25 coincides with the national average we can see the SSU chemistry department’s general chemistry sequence is performing slightly below that.

G) Alumni and where do they go?

As shown in the **Figure 34** below the graduates from the SSU chemistry department for the last five years has had a very high rate of success. In total, roughly 90% of the graduates have either gained admission to some form of post graduate program or obtained a position in the industry. Most of the remaining 10% have lost contact with department with very few having been confirmed not to have obtained a position which involves their undergraduate degree.

Year	Total # Graduates	# Employed in industry	%	# Going to health profession	%	# Going to graduate school	%	Total	%
2008	7	3	42.85714	1	14.28571	1	14.28571	5	71.42857
2009	12	3	25	3	12	6	50	12	100
2010	16	8	50	4	8	2	12.5	14	87.5
2011	22	12	54.54545	3	5.5	6	27.27273	21	95.45455
2012	20	10	50	2	4	5	25	17	85
Total	**77**	**36**	**46.75325**	**13**	**27.80556**	**20**	**25.97403**	**69**	**89.61039**

(Figure 34)

H) Progress on goals set by the external reviewer from the last program review

The complete evaluation from the external reviewer can be found in **Appendix L**.

Have staff report to the Department Chair- Currently all of the staff associated with the chemistry department still report directly to Julie Barnes, the Administrative Manager (AM) of the School of Science and Technology. This situation predates the current chemistry department and is completely outside of their control to change.

Although the staff receive directions and regular reviews from the chemistry department chair the actual evaluation comes from the AM. Unfortunately, this setup has caused some problems, as mentioned by the external reviewer, when conflicts come up over job descriptions ect. Progress has been made to avoid future conflict by modifying staff job descriptions, ensuring new staff hires are completely aware of their job description, ensuring new hires understand that they receive direction from the chemistry chair, and increasing communication between the faculty, staff and the Administrative Manager.

M.S. Chemistry Degree- The chemistry department has given this suggestion careful consideration and has determined that a M.S. chemistry degree would not be feasible without additional courses, additional faculty, additional support staff, and additional research space. The acquisition of these needs is not under the control of the chemistry department and would require additional support from the School of Science and Technology. The general consensus among the chemistry faculty is to focus on developing an excellent undergraduate program as opposed to developing a non-functioning master program. Once again the basis for this suggestion is outside the control of the chemistry department so moving forward is not feasible.

Support Necessary from SSU Contract and Grants Office- Here the external reviewer called for increased ease in submitting grant proposals and more experienced personnel at the Contract and Grants office. Once again the general consensus is that the situation has gotten worse on both counts. The routing for grant proposals has gotten steadily worse. Currently, the proposal endorsement form (PEF) requires thirteen signatures. In particular, since the writing of the previous program review two new signatures, one from environmental health and safety, and one from police services, has been added to the PEF, thereby, making the process more difficult. It should be pointed out that the current SSU PEF and routing process is much more complicated compared to other CSUs.

Another point to make is the continued turn around and/or lack of a program director of the SSU Office of Research and Sponsored Programs (ORSP). Since the last program review there have been three directors of ORSP and the position was left empty for multiple years. This deficiency has made it very difficult for chemistry faulty to submit grants and on at least one occasion has produced problems after the grant has been accepted for funding. Overall, this has made progress in the chemistry department's scholarship and research very difficult.

Facilities-

a) Faculty Research Space- Since the last program review one small lab was obtained in Salazar 2000 which was given to Dr. Fukuto for research space. Also, half of the radiation lab (Darwin 306) was acquired for Dr. Lares as research space.

b) Modern Instrumentation- The chemistry department has been quite successful at acquiring instruments. In particular, we have acquired a new 400 MHz NMR through an NSF grant along with Two GCMS instruments and an AA instrument through donations

c) Faculty offices-The chemistry department has acquired one additional office (Darwin 14) in the Darwin basement, which is currently being used for an adjunct faculty.

d) Teaching labs-No new teaching labs have been acquired by the chemistry department. The space in Carson 102 has been renovated to allow for more efficient use in lower division courses which have a laboratory component. It should be pointed out that the number of lab sections, particularly in the general chemistry sequence, has greatly increased yet there has been no increase in teaching lab space.

e) Chemical Storeroom within the Department- The stockroom has been renovated to allow for additional storage of chemicals. An estimated 5 fold increase in the amount of chemicals stored there has been seen. This has greatly increased the effectiveness of the chemistry department's research and teaching programs.

f) Student club area- Currently the student's club area is still being shared with the Physics students.

g) Department office- Currently the department office is still being shared with the physics department.

Outreach to Alumni- In this area the chemistry department has made significant and unique progress. In particular, developing a defined presence on Facebook and LinkedIn for the SSU chemistry department has allowed for continued connection with recently graduated alumni and reconnection with past alumni. The chemistry department has developed an alumni Facebook page which has over 200 joined alumni. This site is used to update alumni about department news, job posting, and other related chemistry material. In total, this effort has allowed for connection with roughly 50% of the department's alumni and was unique enough to be formally published (Farmer, S. C. Using Social Networking Sites to Connect with Chemistry Alumni. *J. Chem. Ed.* **2013**, 90, 673-675). In addition, the chemistry department has increased efforts to invite alumni to campus to give seminars. Every year the department tries to invite 1-2 past alumni to give a seminar regarding their current work and/or careers.

Outreach to Emeriti Faculty- The chemistry department has tried to meet this suggestion on two fronts. Each year Emeritus faculty member, Don Marshal, hold a departmental party where current and emeritus faculty meet informally. Also, the previously mentioned invitation of alumnus to give seminars is also used to invite emeritus faculty to campus. The emeritus faculty generally attend the seminar, go to lunch with the alumni speaker, and reconnect with the them.

Start-up packages for new hires- Since this program review, the chemistry department has hired two new, tenure-track faculty, Dr. Mark Perri & Dr. Monica Lares. Both of these new faculty members received a start-up package which was significantly better than pervious hires.

Example start-up funds in order of hire to SSU.

Dr. Jennifer Lillig: $3000

Dr. Steve Farmer: $10000

Dr. Jon Fukuto: $10000

Dr. Mark Perri: $20000

Dr. Monica Lares: $25000

Unfortunately, these start-up packages are significantly less than other CSU's with active research programs. A recent chemistry hire to the CSU Channel Islands chemistry department receive $50,000 in startup funds which shows that the start-up funds offered by SSU are woefully behind similar campuses. CSU Channel Island's chemistry department is of a similar size as SSUs and also does not have a masters program. The continued lack of adequate startup funds has become a problem when recruiting new faculty.

Number of New Tenure-track hires- As mentioned in the previous note the chemistry department has acquired two new faculty members one in the area of Analytical/Physical chemistry the other in the area of Biochemistry. These hires were made in anticipation of departmental teaching and research needs.

Development of a Departmental Safety Policy-The SSU chemistry department has been actively developing their safety policies. The first step of this endeavor involved updating the SSU chemistry hygiene plan (CHP) to be more in line with the idea of the chemistry department doing research. In particular, an improved process for obtaining hazardous materials was outlined along with a protocol for the proper management of lab waste. Also, departmental polices were outlined for student working in research labs and student training responsibilities of the chemistry faculty. Lastly, the chemistry department has started a process where research students undergo documented research training during CHEM 316.

Chemistry Club should become Student Affiliate of the American Chemical Society (SAACS)- On this point the chemistry department has decided not to pursue membership. This is for two reasons. First, the ACS requires that a certain number of club members join the ACS. This costs money which the students, the club, nor the department can afford. Also, because of the continued turnover in club membership, this endeavor would require regular membership drives which would require time which the club could better spend elsewhere. Second, after due consideration by the chemistry department faculty, it was determine that the club would gain nothing, other than being able to claim membership, by become an affiliate. Which this in mind it was determined that the effort and money required for the chemistry club to become an affiliate was not worth it.

Additional Technical Staff- Here there has been little progress and an actual regression of sorts. At the time of the previous program review the chemistry department had a stockroom technician at 80% time and an instrument technician at 100% time. Currently, the chemistry department still has a stockroom technician still at 80% time; However, the current instrument technician is at only 50% time. This is unfortunate because an instrument technician is necessary for the maintenance, prepping, and repairs of the instruments used in chemistry teaching and research labs. Despite the fact that the number of teaching and research students has increased during the time of this program review, the number of technical staff has actually decreased. This has caused many of the chemistry department's instrument's to become broken and unusable which has had a marked detrimental effect on the quality of the laboratory experience presented to SSU students.

Development- Here the chemistry department has made strides to meet the goal. In particular, the department has obtained a 400 MHz NMR through a NSF MRI grant. Also, there has been an increased effort to obtain donations through fund raising efforts. The Constant Contact system was used to contact alumni to solicit donations. Recently, the chemistry department has been working with Chris Faydef of the development office to contact established alumni directly to solicit them for donations. In particular, emeritus chemistry faculty Dave Eck has been regularly donating funds to the chemistry department. Lastly, the chemistry department is in the process of holding a Wine Chemistry Seminar which is expected to enhance connections with alumni in the wine industry, local wineries, and the SSU wine business program.

Computational Chemistry in the Curriculum- Currently, computational calculations are incorporated into the second semester of physical chemistry (CHEM 310B) and into the senior integrated lab (CHEM 401). In particular, students use the GAMESS computational package to look at H_2 molecular orbitals, Benzene molecular orbitals, and various vibrational modes. It should be noted that a four computer cluster has been created so that these calculations can be run locally by students.

Additional Departmental retreats-Since this program review the chemistry department has held regular, multi-day retreats. During these retreats details for course assessment, departmental goals, course learning objectives, curriculum improvements, and future directions were all laid out.

Assigned Time for Lecturers-This suggestion was met by only having chemistry lecturers perform duties that they are specifically paid for, such as teaching and grading. Although chemistry lecturers did perform outside duties at one point this is no longer the case.

Open Access for Faculty to Chemistry Stockroom- Here great strides has been made. In order to allow for the chemistry faculty access, the stockroom was completely redone and an accurate, functional equipment inventory was created. Also, the chemical storage shed was completely rearranged to allow for easier access, the inventory was updated, keys to the shed were obtained for the faculty, and many of the chemicals were returned to the chemistry department stockroom. A system was set up where faculty can obtain equipment and/or chemicals freely with communication with the stockroom technician. Is should be pointed out that virtually all of these endeavors were performed the chemistry faculty.

Summary- The chemistry department feels that it has made as much progress as possible toward the suggested goals. In particular, goals which are under the direct control of the chemistry department (i.e. 5, 6, 9, 10, 13, 14, 15, & 16) were given the greatest consideration and progress was made in all counts. However, in suggestions which involve support from the campus (i.e. 1, 2, 3, 4, 7, 8, 11, & 12) mixed results were seen. No progress was made in suggestions 1, 2, 7, 8, 12. Some progress was made in suggestions 4, 7 & 8 and an actual worsening was seen in goals 3 & 11. It is clear that the progress of the chemistry department would greatly enhanced by the increased support by the SSU campus.

I) Progress on departmental goals

Chemistry Department Goals, Measurable Objectives, and Assessment Methods

1. Goal: deliver a modern curriculum in both content and pedagogy that extends beyond the standard classroom experience

Measurable Objectives:

A) Offer electives in current topics (3-6 units) to bring our department in line with other chemistry departments in the CSU and nationally

Starting in Spring 2012 the chemistry department implemented chemistry 496 which is an elective taught in rotation by the chemistry faculty. The course can be 3 or 4 units, however, all of the courses thus far have been 4 units. The content of the course is decided on by the instructor and generally involves their area of chemical expertise. Virtually all of the chemistry faculty have taught this course at least once which means the chemistry students have been exposed to a wide variety of elective courses. This chemistry elective has been incorporated into all three of the department's degree pathways.

A comparison shows that SSU chemistry department's course offerings are in line with other similar CSU chemistry departments **(Figure 35).**

Course	Sonoma	San Marcos	Bakersfield	San Bernardino	Chico	Humboldt	Stanislaus	Dominguez Hills	Channel Islands
Chemistry in Society	X		X	X	X	X	X	X	X
Intro to General Chemistry	X		X	X		X		X	X
Combination Gen / Org Chemistry for Nursing	X	X	X	X	X	X	X		
Year-Long General Chemistry + Lab	X	X	X	X	X	X	X	X	X
Quantitative Anal. + Lab	X	X	X	X	X	X	X	X	X
Year-Long General Chemistry With quant. + Lab	X								
One Semster Organic Chemistry For Non-Science Majors					X	X			
Year-Long Organic Chemistry + Lab	X	X	X	X	X	X	X	X	X
Introduction to Pysical Chemistry for bio. Students				X		X			
First Semester Physical Chemistry Lecture	X	X	X	X	X	X	X	X	X
Second Semester Physical Chemistry Lecture	X		X		X	X	X	X	X
First semester Physical Chemistry Lab		X	X	X		X	X		X
Second Semester Physical Chemistry Lab			X				X		
First Semester Inorganic Chemistry Lecture	X		X	X	X	X	X	X	X
Second Semester Inorganic Chemistry Lecture				X	X	X			
One Semester Inorganic Chemistry Lab			X	X		X	X		
One Semster Biochemistry for Nurses				X	X	X			
First Semester Biochemistry lecture	X	X	X	X	X	X	X	X	X
Second Semester Biochemistry lecture	X		X	X	X	X	X	X	X
Intro to Research Methods	X								
Biochemistry lab	X	X	X	X	X	X	X	X	
First Semester Intergrated Lab	X			X	X		X	X	
Second Semester Intergrated lab	X				X		X	X	
Seminar	X		X	X	X	X	X		X
Instrumental Analysis	X		X	X	X	X	X		X
Biologica Chemistry									X
Clinical Chemistry								X	
Chemical Thermodynamics					X				
Molecular Modeling						X			
Environmental Chemistry		X	X	X	X	X	X		X
Environmental Toxicology									
Concepts of Geochemistry			X					X	
Energy in Society		X							X
Science of Winemaking			X				X		
Toxicology					X			X	
Forensic Chemistry			X				X		X
Synthetic Organic Chemistry					X				X
Physical Organic Chemistry					X				
Advanced Organic Chemistry						X	X		
Advanced Organic Laboratory					X	X			
Selected Topics in Chemistry	X				X	X	X	X	X
Undergraduate Research	X		X	X	X	X	X	X	X

(Figure 35)

At first glance it may appear the SSU chemistry department may be lacking an inorganic and physical chemistry lab. The SSU chemistry department decided to incorporate inorganic and physical chemistry experiments into their first semester integrated laboratory. However, upon close examination the SSU chemistry department is one of the only chemistry department investigated which does not regularly offer an environmental chemistry course. It should be noted that the SSU chemistry department is only one investigated which offers a year-long general chemistry with quantitiave analysis sequence and a year-long research training course.

B) Follow ACS guidelines for course offerings

Both the BS Chemistry and BS Biochemistry are certified by the ACS which shows that chemistry department is following their guidelines.

C) Offer a year-round seminar program

Starting in fall of 2008 the chemistry department started holding seminars during the fall semester in addition to the usual seminars held in the spring (Chem 497). Starting in 2010 the fall seminar series was formally made a course, Chem 492, which is available for any student to take for one unit. Overall, Chem 492 has been very successful with an average of 20 students taking the course every year. The seminar program has been receiving regular funding via an internal SSU IRA grant. This grant has allowed for higher quality speakers and increased interaction between the speaker and students. Since the acquisition of the IRA grant the chemistry department has been hosting roughly 15 seminar speakers per year.

D) Utilize current educational techniques and technologies like clickers, peer-led instruction, collaborative learning

The SSU chemistry department has actively incorporating current education techniques into their curriculum. In particular, the freshman learning cohort taught by Dr. Works used group activities, peer mentorship, and the utilization of IPhone for class activities. In addition, Dr. Lillig has utilized the flip classroom technique and group work in her courses. Lastly, Drs. Su and Lares have used IClickers during their lectures. Overall, the following chemistry courses, Chem 497, Chem 315/316, Chem 441, and Chem 402 all involved projects where students critique each other’s work in a collaborative manner.

E) Offer integrated capstone experiences with a written thesis

After much consideration, the chemistry department has decided to not have students perform written theses. This decision was made in part due to the ever changing nature of the capstone courses. Also, the increasing number of chemistry majors would make it difficult for theses to be read by two faculty members.

F) Provide student access to modern instrumentation and an instrumentation class

Starting in Fall 2012 the chemistry department started to offer a purely instrumental analysis course, Chem 275. The addition of this course was important because it brought the SSU chemistry department in line with the course offerings of other equivalent CSU chemistry departments. Although this course is purely lecture the capstone courses Chem 401, 402 & 441 and research courses Chem 315/316 & 494 all focus heavily on instrumentation. The chemistry department has actively tried to improve on its instrumentation. The department successfully acquired a new 400 MHz NMR (Major Research Instrumentation Acquisition. National Science Foundation. “MRI: The Acquisition of a 400 MHz NMR Spectrometer.” $329,513. (2011)). In addition, two GC/MS instruments were donated to the department. Lastly, a TUES grant was written in an attempt to acquire computers for chemical computations M.J. Perri (2012). Development of a Community Chemistry Cluster. NSF Transforming Undergraduate Education, $200,000

Assessment:

Goals A-D have been clearly met by the chemistry department.

Goal E was abandoned. However, this was due to a lack of manpower in the chemistry department and not due to a lack of effort

Goal F was met. With the acquisition of a new 400 MHz NMR the chemistry department has instruments which are comparable to other CSU's of a similar size.

2. Goal: provide realistic, cutting-edge, and quality year-round research training

Measureable Objectives:

A) Faculty are successful in publishing and obtaining funding for their work

Here the SSU chemistry faculty have been extraordinarily successful having published 40 manuscripts since the previous program review. The fact the chemistry faculty are all performing publishable research shows that the efforts are cutting edge. A complete list of publications can be found in **Appendix I**.

The chemistry faculty have also been very successful in obtaining funding for their scholarly efforts. In total 49 grants have generated over 2,235,000 dollars of support. A complete list of successful grants written by the Chemistry Faculty can be found in **Appendix J**.

B) Faculty and students attend conferences and present results at conferences and other universities

Virtually all of the Chemistry Department's faculty have been active in presenting at conferences and other universities. In total 43 presentations have been made by Chemistry faculty since the last program review. A complete list can be found in **Appendix K.**

Even more so the students have been active in presenting work at conferences. In total **104** presentations have been made by Chemistry students since the last program review. A complete list can be found in **Appendix F.**

C) Offer a year-round seminar program

See 1C above

D) The department is successful in acquiring and maintaining modern instrumentation

See 1F above for instrument acquisitions

At the time of the previous program review the chemistry department had an instrument technician at 100% time. However, the current instrument technician is at only 50% time. This is unfortunate because an instrument technician is necessary for the maintenance, prepping, and repairs of the instruments used in chemistry teaching and research labs. Despite the fact that the number of teaching and research students has increased during the time of this program review, the number of technical staff has actually decreased. This has caused many of the chemistry department's instrument's to become broken and unusable which has had a marked detrimental effect on the quality of the laboratory experience presented to SSU students. In addition, the lack of a regular equipment fund has caused the chemistry to continually dip into its own OE funds to cover repair costs. This also has caused many departmental instruments to remain broken for long periods of time.

Despite the importance of instrumentation, the chemistry department has been forced to continually request funds from the SST dean or the SSU provost.

E) The department receives support from its school and university (monetary, appropriate credit to faculty for supervising undergraduate researchers and writing grant proposals, technician support, matching funds)

This endeavor has been less than successful. The department's operating expense budget has not increased in the time since the previous review. Since the time of the previous review the faculty have gone to a typical teaching load of 9 unit to a typical load of 12 units. Virtually all of the chemistry faculty teach a unit overload each semester in order to supervise undergraduate researchers. Most research active CSU chemistry department's faculty teaches a 9 unit load to compensate for the time used in mentoring research students and writing grants. In addition, the chemistry technician position has dropped from 100% time to 50% time. Lastly, it has been made abundantly clear that matching funds will not be provided by the campus, and that any indirect funds generated from grants will be completely absorbed by the campus.

Although there has been a constant call for increased ease in submitting grant proposals and more experienced personnel at the Contract and Grants office. Once again the general consensus is that the situation has gotten worse on both counts. The routing for grant proposals has gotten steadily worse. Currently, the proposal endorsement form (PEF) requires thirteen signatures. In particular, since the writing of the previous program review two new signatures, one from environmental health and safety, and one from police services, has been added to the PEF, thereby, making the process more difficult. It should be pointed out that the current SSU PEF and routing process is much more complicated compared to other CSUs.

Another point to make is the continued turn around and/or lack of a program director of the SSU Office of Research and Sponsored Programs (ORSP). Since the last program review there have been three directors of ORSP and the position was left empty for multiple years. This deficiency has made it very difficult for chemistry faulty to submit grants and on at least one occasion has produced problems after the grant has been accepted for funding. Overall, this has made progress in the chemistry department's scholarship and research very difficult.

F) Students successfully gain entrance into graduate school or industry jobs

Year	Total # Graduates	# Employed in industry	%	# Going to health profession	%	# Going to graduate school	%	Total	%
2008	7	3	42.85714	1	14.28571	1	14.28571	5	71.42857
2009	12	3	25	3	12	6	50	12	100
2010	16	8	50	4	8	2	12.5	14	87.5
2011	22	12	54.54545	3	5.5	6	27.27273	21	95.45455
2012	20	10	50	2	4	5	25	17	85
Total	**77**	**36**	**46.75325**	**13**	**27.80556**	**20**	**25.97403**	**69**	**89.61039**

(Figure 36)

As shown in the **Figure 36** the graduate from the SSU chemistry department for the last five years have had a very high rate of success. In total roughly 90% of the graduates have either gained admission to some form of post graduate program or obtained a position in the industry. Most of the remaining 10% have lost contact with department with very few having been confirmed not to have obtained a position which involves their undergraduate degree.

G) Hold regularly scheduled group meetings

The chemistry department has been holding year-round department group meetings. Various members of the biology department have also participated in these meetings. In these meetings, students or faculty discuss their research or literature related to their research in an informal manner. Seminar speakers often participate in these group meetings. These group meetings have been quite successful and are usually attended by roughly 20 students and 6-8 faculty members.

Assessment of Objective 2

Objectives A, B, C, F, G the chemistry department has done phenomenally well.

For Objective D the lack of an instrument technician has been a defined drain on the resources of the chemistry department.

For objective E the chemistry department has not been receiving adequate support for their research efforts.

3. Goal: help students prepare for their future in a manner that will allow them to be successful

Measurable Objectives:

A) Students successfully gain entrance into graduate school or industry jobs

See 2F above

B) Students successfully complete an independent laboratory project

With the inclusion of the chemistry research training courses, Chem 315/316, students taking a BS chemistry or biochemistry degree are required to participate in a research project. In addition, many students who are on the BA chemistry pathway still participate in a research project through the course Chem 494.

C) Students effectively communicate their laboratory work in oral, written, and poster formats.

All chemistry lab courses past general chemistry require detailed, type-written lab reports for each experiment preformed. In addition, students in chem 401 are required to give a 50 minute oral presentation on a topic related to the course, students in the Chem 315/316 series are required to write a project proposal, a project summary, and give a 20 minute seminar regarding their research project. Students in Chem 497 are required to give 20 minute seminar to the department. Students in Chem 441 and 402 are required to give a project proposal defense. Also, students in Chem 315, 402, & 441 are generally required to give a poster presentation. Lastly, many student give presentations at conferences as mentioned in 2B above.

D) Provide opportunities for students to hold TA/SI/peer-instructor positions with proper training

To facilitate this goal the chemistry department has created a SI/TA facilitator position in the chemistry department. This position is in charge of: putting out a call for student positions each semester, overseeing a department meeting dividing the student volunteers amongst the chemistry courses, and coordinate with the tutorial center so that the SI process runs smoothly. In addition to the usually TA and SI positions, the chemistry department has also created stockroom helper positions to help students who are interested in industry positions after graduation. SI training is provided by the tutorial center. The tutorial center performs student evaluations for chemistry SI's each semester. The results from Fall 2013 are located in **Appendix G**. In all cases the chemistry students revived many excellent written comments and their numerical scores were mostly 5's (Strongly Agree) for the questions which evaluate their helpfulness.

Assessment of Goal 3

All objectives have been met. The chemistry department should consider a method to evaluate the presentations of students.

4. Goal: nurture students and mentor them through individualized and honest guidance for their scholarly development

Measurable Objectives:

A) Require annual advising appointments for every chemistry major

Due to the increasing number of chemistry majors the department has stopped doing annual advising appointments. Instead, we have focused on advising for incoming freshmen and open advising appointments.

B) Maintain a faculty and staff that are accessible to students for questions and conversation

First, all of the chemistry faculty have an open door policy, in addition to regular office hours, which means they are continually available. As previously discussed, the chemistry department holds weekly departmental group meetings where students and faculty have informal discussions about the day's topics. In addition, the chemistry department holds informal parties each semester where faculty and students can mingle.

C) Hold regularly scheduled group meetings

See 2G above

D) Provide 4-year (or appropriate) academic planning for entering students

Here the chemistry department has focused on advising freshmen chemistry students. First of all advising is given to incoming freshmen during the SOAR advising sessions. Also, during their freshman year many chemistry students are expected to meet with their advisor and develop a four year plan. This process gets students to start thinking about their 4-year plans and introduces them to their academic advisors.

E) Maintain and support a chemistry club

The chemistry department has an active chemistry club with an average of 20 members. The chemistry club has been increasingly active with community outreach events such the National Chemistry Day demonstrations and attending the science fairs of local elementary schools. Also, the chemistry club has increased holding social event such as; ski trips, invited speakers, trips to local theme parks, and tours of local industries. The chemistry club is supported by the chemistry thought the sales of laboratory manuals.

F) Provide information and knowledge for career opportunities

There are two main ways that students are informed about career opportunities. First, the chemistry faculty give at least one seminar per year specifically designed to discuss career opportunities for students. Second, the year-round seminar series provides a wide variety of seminars which educate students about their possible career opportunities including; job placement agencies, speakers from industries, and speakers from various universities.

Assessment of Goal 4

All objectives have been met. The chemistry department should consider a method for directly assessing these objectives such a student survey.

5. Goal: engage in meaningful conversation about and provide support for professional development of faculty and staff

Measurable Objectives:

A) Hold annual retreats to discuss curriculum and programming

Since this program review the chemistry department has held regular, multi-day retreats every year. During these retreats details for course assessment, departmental goals, course learning objectives, curriculum improvements, and future directions were all laid out.

B) Maintain a yearly seminar program

See 1C above.

C) Obtain resources for faculty to attend workshops and conferences in teaching and research

In addition to faculty development money from the SSU campus, the chemistry faculty have obtained travel funds from CSUPERB to attend conferences. Dr. Works received funds from the SSU STEM grant to present at the national ACS conference in San Diego. Lastly, emeritus faculty Dr. Eck has regularly donated funds which are used to pay for students to attend various conferences.

D) Provide opportunities for staff to attend training workshops in their field

The new chemistry department AC Andrea Cullinen has received training on the Adobe format.

E) Provide appropriate credit and time for the preparation of research proposals and publications

See 2E Above

F) Obtain adequate facilities to house scholarly endeavors

1) Faculty Research Space- Since the last program review one small lab was obtained in Salazar 2000 which was given to Dr. Fukuto for research space. Also, half of the radiation lab (Darwin 306) was acquired for Dr. Lares as research space.
2) Modern Instrumentation- The chemistry department has been quite successful at acquiring instruments. In particular, we have acquired a new 400 MHz NMR through an NSF grant along with Two GCMS instruments and an AA instrument through donations
3) Faculty offices-The chemistry department has acquired one additional office (Darwin 14) in the Darwin basement, which is currently being used for an adjunct faculty.
4) Teaching labs-No new teaching labs have been acquired by the chemistry department. The space in Carson 102 has been renovated to allow for more efficient use in lower division

courses which have a laboratory component. It should be pointed out that the number of lab sections, particularly in the general chemistry sequence, has greatly increased yet there has been no increase in teaching lab space.

5) Chemical Storeroom within the Department- The stockroom has been renovated to allow for additional storage of chemicals. An estimated 5 fold increase in the amount of chemicals stored there has been seen. This has greatly increased the effectiveness of the chemistry department's research and teaching programs.
6) Student club area- Currently the student's club area is still being shared with the Physics students.
7) Department office- Currently the department office is still being shared with the physics department.

Assessment of Goals 5

Objectives A, B have been clearly met.

Objectives C has been adequately meet due to the faculty development funds offered by the campus.

Objective D has not been met. With the acquisition of two new staff members the chemistry department should promote their training.

Objective E has not been met. As discussed earlier the chemistry department's faculty have not been compensated for their research efforts for the last four years.

Objective F has not been met. With the acquisition of new faculty member the chemistry department has not seen a corresponding increase in research, teaching or office space. The chemistry department is at a point now where the space has become a limiting factor in growth.

6. Goal: have a high quality department in terms of students, faculty, staff, available resources, and modern facilities and instrumentation

Measurable Objectives:

A) Obtain a high-field NMR and LC-MS

A new 400 MHz NMR was obtained in 2011 through an NSF TUES grant. Thus far one attempt has been made to obtain a LC-MS through an NSF grant.

B) Obtain an NSF-REU

Three attempts were made to obtain an NSF-REU grant. This effort has been tableted in lieu of developing a solid summer research program for SSU students.

C) Obtain an instrument technician

Here there has been little progress and an actual regression of sorts. At the time of this program review the chemistry department had a stockroom technician at 80% time and an instrument technician at 100% time. Currently, the chemistry department still has a stockroom technician still at 80% time; however, the current instrument technician is at only 50% time. This is unfortunate because an instrument technician is necessary for the maintenance, prepping, and repairs of the instruments used in chemistry teaching and research labs. Despite the fact that the number of teaching and research students has increased during the time since the previous program review, the number of technical staff has actually decreased. This has caused many of the chemistry department's instrument's to become broken and unusable which has had a marked detrimental effect on the quality of the laboratory experience presented to SSU students.

D) Implement a minimum "C" requirement in all chemistry courses for chemistry majors

This plan has been tabled at this time.

E) Provide honest and thorough performance reviews for all faculty and staff

Since the time of the previous program review the chemistry department has written a set of RTP guidelines for tenure track faculty members. In addition, the chemistry department has written a set of guidelines for the evaluation of temporary faculty membesr. The chemistry department has formed a specific committee for the evaluation of temporary faculty members and started preforming yearly evaluations. This was not previously done.

F) Utilize CHEM 125AB as a tool ("Freshman Experience") for preparing chemistry majors for upper division coursework

To help facilitate this goal the Chem 125AB series was turned into a freshman learning cohort through the addition of the course "Thinking Like a Scientist" Chem120AB. These courses were blended together and are team taught by two chemistry faculty. In these courses, chemistry majors are prepared for upper division coursework by teaching them to evaluate data using the scientific method. This idea is finalized by have the students perform a culminating experience project. In this project student look at three different literature manuscripts and analyze them. The students are taught to work in groups, have group discussions, and give presentations. This helps the students to form a bond so that they will be connected in later chemistry coursework.

G) Partner with local high schools and JCs to facilitate the transition of students into our program

The chemistry department has performed several projects to help meet this goal. First, the chemistry department has worked with the SSU School of Science and Technology in the Summer High School STEM Internship Program (SHIP). This program has matched promising Sonoma County high school juniors with faculty mentors at SSU to collaborate on research projects in the areas of science, technology, engineering, and mathematics. These students then act as ambassadors to relay the highlights of their work to their classmates, friends, counselors, teachers, and principals during their senior years. The chemistry department has been active in this program from its start. Typically at least two chemistry faculty participate in this program every year.

The acquisition of a NMR has opened new opportunities to connect with local community colleges. In particular, a group of students from Mendocino Community college visited the SSU chemistry department to use the NMR. Also, the chemistry department has been active in the Agilent research academy. In this program, local high school students brought in during the summer to work on a research project for two weeks. Lastly, the chemistry department has recently started a program of talks given to high school students. These talks are designed to generate interest in chemistry.

Also, the chemistry department has begun a public outreach effort where faculty member speak at local High Schools. Thus far presentations have been given to five local High Schools.

H) Hold advising open-houses for potential majors

The chemistry department has been actively participating in the SSU Seawolf day. Here the chemistry department has tabled and provided advising to interested incoming freshmen. Also, the chemistry department has given tours to these students.

I) Allow majors to repeat a total of 3 chemistry classes, they must meet with the department curriculum committee to discuss their new academic plan for success in the course; students with special circumstances may petition the department to waive this requirement.

J) Require an overall 2.0 GPA requirement in the chemistry major for graduating chemistry majors

It was determined that the campus has a 2.0 minimum GPA for all graduating students. It was determined that it was unnecessary for the chemistry department to pursue this idea for further.

Assessment of Goal 6

Goal A was partially met with the acquisition of an NMR

Goal B and C were not met mainly due to a lack of support from the school of science and technology.

Goals D, K, J were found to already be met by the SSU campus.

Goals E-I were met.

7. Goal: work collaboratively, work as a team, and maintain close working relationships within our chemical community and the community at large

Measurable Objectives:

A) Establish partnerships with local schools and industry

See 6H above for local schools. The chemistry department has made a unique connection with the local business Thermochem. The partnership places research students enrolled in Chem 315/316 directly at Thermochem. It should be noted that at least one of these placements has turned into a formal paid position. Recently, the chemistry department has initiated a wine seminar. This specials seminar will be used to invite interested businesses from the local wine industry.

B) Obtain an NSF-REU

See 6B above.

C) Hold annual gatherings for members of the chemical community

The chemistry department will be holding a Chemistry Wine seminar where alumni, students, and members of the local community will be invited.

D) Provide support for the Chemistry Club

See 4E Above

E) Hold an annual team-building exercise for all faculty and staff

As part of the annual retreats, the chemistry department has started performing team-building exercises. Also, the chemistry department has been involved in more informal parties.

F) Provide opportunities in the classroom for students to solve problems together

See 1D, 2G & 3D above

Assessment for Goal 7

Objectives A-C were marginally met mainly due to a lack of manpower in the chemistry department.

Objectives D-F were met

5) Challenges Facing the Department

A) Lack of TT hires and an unstable pool of temporary faculty

Since 2009 we have replenished the temp pool 3 times and performed 2 successful visiting professor searches. During this same period we received, and successfully completed, one TT hire. Conversations with other CSUs and universities in the bay area as well as potential adjuncts have suggested a primary obstacle in staffing a stable temporary pool is our location. Our distance from metropolitan areas coupled with the fact that most temporary faculty work at multiple universities and junior colleges make it difficult for temporary faculty to get to SSU. Repeated committee based searches to replenish the temporary pool is a drain on TT faculty time and the prospect of emergency hires every semester is a daunting task for the department chair. Large numbers of temporary faculty teaching few courses also lead to increased time dedicated to training and evaluation. We have also had temporary faculty leave mid-semester and some don't show up to class, as they do not take the commitment seriously. Since they are teaching at other colleges or have other full-time jobs, temporary faculty are also not on campus as often which makes it more difficult to support the students in foundational courses. Together these issues causes continuity problems, a decrease in instructional quality, and difficulty in mounting the classes necessary to serve our majors, SST, and SSU as a whole. As our department ages, this problem is compounded by faculty leaves (sabbatical, buyout for grants and service, family leave). We currently deal with this issue haphazardly and to the best of our ability. However, many of the classes directly impacted by decreased quality are fundamental because these are foundation courses for multiple departments.

B) Lack of time for coordination of large lecture-lab courses

Additionally, multiple faculty teaching in one course (for example a first semester general chemistry course with one TT instructor in the lecture and one lab and 3-4 additional temporary coupled with additional lecture and lab sections with other instructors) are difficult to find common meeting times and generally difficult to maintain communication in order to organize and coordinate the courses without any coordination release. This also puts a drain on the stockroom to coordinate with so many instructors for one class. To deal with this issue faculty have been trying to put together instructor manuals when time and increase their own commitment time to additional course development utilizing high impact practices to increase student success in these large courses considered to be "gateway bottlenecks" to STEM.

C) Lack of staff support

The chemistry department's dedicated instrument support technician retired during the last program review cycle and his position has not been fully replaced. Instead, the School of Science hired a school instrument technician, dedicated half-time to chemistry. However, this individual does not have a background in chemistry or chemistry instrumentation to adequately support, maintain, and repair instruments without direct chemistry faculty supervision. In addition, SST indicated a half-time technician dedicated to NMR maintenance would be provided in conjunction with the NSF MRI award. Although SST has allowed the department to provide 3 WTUs to an adjunct faculty member to help with the instrument, the promised technician position has not been provided. Lack of staff support, coupled with increased FTES overall, has of course led to instruments breaking. Some faculty dedicate additional time to instrument repairs and the department has attempted to obtain IRA funds to support a position, In order to get these instruments repaired, the department sends a written request to the dean who then makes a request from the Provost. We are fortunate that these requests have been granted but it is a tedious and demoralizing process that is difficult to keep track of. It would not surprise us to learn that the amount spent in instrument repair and in requesting companies visit to service the instruments (outside of service contracts) would in fact cost more than an actual instrument technician. Additionally, more staff support would allow us to expand our course offerings into the evening.

E) Scholarship

The chemistry department is active in scholarship and grant writing and are reaching a point where the process is becoming successful for extramural funding awards. However, our efforts in this area have been inhibited in a few specific ways. First, lack of support from the Office of Grants and Contracts. Personnel in the office have turned over repeatedly and the office currently does not have expertise in the process let alone the ability to help faculty find additional funding sources outside of the NSF and NIH. We have been provided misinformation from the office and the steps involved in obtaining campus approval for submission are tedious and drawn out. Second, indirects are not returned to the PIs regularly or in a predicted amount. This makes it difficult to support grant operations at the department level. Additionally, with faculty teaching 12 WTU per semester, grant writing is done in our "off" time, like winter and summer breaks, with no support. High teach loads also make it difficult to support our research with undergraduate students as we spend so many hours in class that it is difficult to find time for proper mentorship. The department has attempted to address this final issue by reorganizing its introductory research course into a formalize course led by a single instructor. Although all faculty participate in the course and take students into their labs, that single instructor manages the process and assigns grades. This new format has helped add a sense of gravitas to the course from the student perspective, thereby increasing productivity in some cases and allowing less productive students to meet their research requirements adequately without becoming a drain on their mentor's time. The department has also requested to teach a 9+3 WTU model where 3 WTU would be used directly for undergraduate student research supervision and scholarship related activities like grant writing. This is similar to the support received by other research active departments in our school, like the department of biology.

F) Lack of a 12-month chair

The Department of Chemistry currently receives 6 paid summer days for the chair to complete duties. However, in addition to regular SSU duties such as assessment reports and summer advising, chemistry also has department specific work to complete such as yearly ACS reports and 5 year reviews as well as oversight for summer lab work done not only by faculty and students in the department, but in collaboration with other SSU based programs such as Upward Bound and EXCEL which utilize our lab spaces. We believe it is a safety issue to not have such an active department fully chaired in the summer. In addition, impaction in lower division chemistry courses results in a high amount of chair-student contact over the summer.

G) Lack of budget transparency

There is a lack of budget transparency and budgetary freedom in our department. For example, last year, when we looked at our OE account midway through the year- there was nothing there except a grant received from the Green Music Center. We have no options to save funds (that we could use for instrument repairs or purchases) and no flexibility to make our own decisions regarding how to utilize a budget. This breeds a lack of trust and the resulting micromanagement of enrollment is draining.

H) Space

The department is currently maxed out on both office space, general lab space, and space for PIs to work with students on undergraduate research students. After years of requests, the department was able to get the laboratory in Carson 1 renovated and fully functional so that we could increase our lower division chemistry lab offerings to better serve SST and SSU as a whole. We currently have no available lab space for new tenure track hires, which will make it difficult to attract quality candidates.

6) Overall Assessment and findings

A) Comparison to other CSU chemistry departments of a similar size

When comparing the SSU chemistry department to eight other CSU chemistry departments which are of a similar size. It was determined that the SSU chemistry department has a curriculum which is equivalent to other CSU chemistry departments. However, upon close examination the SSU chemistry department is one of the only chemistry departments investigated which does not regularly offer an environmental chemistry course. It should be noted that the SSU chemistry department is the only one investigated which offers a year-long general chemistry with quantitative analysis sequence and a year-long research training course.

It would appear that 7-8 is the typically amount of faculty for the smaller CSU chemistry departments. In this comparison, it would appear that SSU is in-line with other CSU's in terms of number of faculty. In this comparison it would appear that 6.6 is the average number of adjunct faculty in CSU chemistry departments similar to SSU. Here again the SSU chemistry department is slightly less than the average but still within acceptable parameters.

I am very disappointed to point out that the departmental OE given to the SSU chemistry department is at the bottom of the compared CSU's by a substantial amount. Given that the average OE is $53,000 it is clear that the $10,000 given to the SSU chemistry departments represents a significant problem.

Here again, I am disappointed to report that the start-up funds given to new SSU chemistry faculty is significantly on the bottom of all the CSU's. Considering that the average start-up package is $43,000 the $25,000 given by the SSU chemistry department is out of competition with other CSU's. This may present a problem with recruiting new faculty in the future.

The typical number of office support staff is between 0.5 and 1. Here the SSU chemistry appears to be in-line with other chemistry departments. Apparently, it is common for chemistry departments to share office staff with departments.

A typical number of instrument support staff is between 0 and 0.5 for chemistry departments of a similar size as SSU's. I am happy to say that SSU appears to be in-line with other CUS's in this regard.

In regards to stockroom staff, I am very sad to point out that the SSU chemistry department is at the very bottom of this comparison. The average number is 1.6 and SSU literally has half that with 0.8. I feel obligated to point out SSU has less stockroom staff than the smallest of the CSU chemistry departments. I feel this represents a significant problem especially considering the fact that many of these chemistry departments do not have an active undergraduate research program like SSU's

B) Growth of the chemistry department

Over the last five years the chemistry department has been undergoing linear growth. This can be clearly seen in the graphs of number of majors and number of graduates per year. On average the total number of chemistry and biochemistry majors has increased by 12 per year and the total number of graduates per year has increased by 3. When looking at the graph showing the percentage of the total number of SSU students who are chemistry majors it is clear the chemistry department is growing faster than SSU. During the last five years the percentage of SSU students which are chemistry majors has increased from 1.2 to 2.6%. The growth of the SSU chemistry department is fairly unique. When looking at the graphs which compare the growth rates of SSU with eight other similarly sized CSU campuses on CSU Bakersfield was shown to have a similar growth curve. Overall, the fact that the number of majors and graduates from SSU is growing at a rate quicker than the rest of the eight other compared CSU's can be seen when looking at SSU's contribution to the total number of majors and graduates from all CSU's. Over the last five years the percentage of all CSU chemistry majors residing at SSU increased from 2.3 to 3.8% while the percentage of all CSU chemistry and biochemistry majors graduating from SSU increased from 1.5 to 4.4%.

C) Assessments of the learning outcomes for the overall program

Learning outcome	Assessment questions	Raw Scores on exit exam	Average Scores on Exit Exam
1	3, 12	1.8, 1.8	1.8
2	6, 18	3.1, 3.6	3.35
3	4, 17	2.1, 2.3	2.2
4	1, 5, 16	3.6, 3.2, 3.7	3.5
5	8, 13, 20	2.9, 3.8, 3.6	3.4
6	7, 10, 19	3.5, 2.1, 4.8	3.7
7	11, 15	3.4, 2.7	3.05
8	2	2.8	2.8
9	9, 14	3.6, 4.0	3.8

(Figure 23)

Learning outcomes which are being strongly met (Score >3.3)

2) Understands the difference between thermodynamics and kinetics as it pertains to the fate of a reaction. (related - knows the difference between a rate and rate constant).
4) Understand the concepts of acids and bases, neutralization and buffers
5) Have a good grasp of stoichiometry, writing chemical equations, predicting products and basic categorization of chemical reactions and a fundamental understanding of chemical reactivity.
6) Data manipulation and interpretation
9) Understand basic chemical bonding theory including drawing Lewis dot structures, and recognizing hybrid orbitals and molecular orbital theory.

Learning outcomes which are marginally being met (Score 2.8-3.3)

7) Lab workmanship- maintaining a good lab notebook, basic lab skills, scientific ethics in data collection, reporting and lab safety. Trouble shooting and experimental design
8) Working skills and knowledge in instrumentation and computer literacy

Learning outcome which strongly not being met (Score <2.8)

1) Understand both the concepts and mathematics of the basic thermodynamic properties and the three laws of thermodynamics. This includes enthalpy, entropy and free energy ($\Delta G = \Delta H - T\Delta S$)
3) Understand the components of solutions, including physical knowledge of how to make a solution, and perform serial dilutions (both the concept and the calculations),

Learning outcome 10 "Reading and interpretation of chemical literature and communication skills (oral and written)"

All chemistry lab courses past general chemistry require detailed, type-written lab reports for each experiment preformed. In addition, students in chem 401 are required to give a 50 minute oral presentation on a topic related to the course, students in the Chem 315/316 series are required to write a project proposal, a project summary, and give a 20 minute seminar regarding their research project. Students in Chem 497 are required to give 20 minute seminar to the department. Students in Chem 441 and 402 are required to give a project proposal defense. Also, students in Chem 315, 402, & 441 are generally required to give a poster presentation. Even more so, the students have been active in presenting work at conferences. In total **104** presentations have been made by Chemistry students since the last program review.
Learning outcome 11 "Ability to implement career planning"

As shown in the table the graduate from the SSU chemistry department for the last five years have had a very high rate of success. In total roughly 90% of the graduates have either gained admission to some form of post graduate program or obtained a position in the industry . Most of the remaining 10% have lost contact with department with very few having been confirmed not to have obtained a position which involves their undergraduate degree.

Overall assessment of departmental learning outcomes

Based on the assessment methods available the chemistry department has been doing phenomenally well.

Only learning outcomes 1 & 3 were found to be lacking. It should be noted that the material covered in these learning outcomes is generally cover in general chemistry. A significant number of our graduating majors do not take general chemistry at SSU.

D) SI evaluations and departmental SETE's

The tutorial center performs student evaluations for chemistry SI's each semester. In all cases the chemistry SI's revived many excellent written comments and their numerical scores were mostly 5's (Strongly Agree) for the questions which evaluate their helpfulness.

In fall 2013 the cumulative SETE scores for the whole department were acquired. In total 854 evaluations were obtained coming from every chemistry course at SSU. For every question the chemistry faculty was scored between 4.00 and 4.50 on a scale of 1-5 with 4 being effective and 5 being very effective. The lowest score for the department was 4.07 seen on the question "My instructor makes difficult topics understandable." The highest was a 4.43 and was seen in the question "My instructor displays competence in course topics."

E) Progress on goals set by the external reviewer from the last program review

The complete evaluation from the external reviewer can be found in **Appendix L**.

The chemistry department feels that it has made as much progress as possible toward the suggested goals. In particular, goals which are under the direct control of the chemistry department (i.e. 5, 6, 9, 10, 13, 14, 15, & 16) were given the greatest consideration and progress was made in all counts. However, in suggestions which involve support from the campus (i.e. 1, 2, 3, 4, 7, 8, 11, & 12) mixed results were seen. No progress was made in suggestions 1, 2, 7, 8, 12. Some progress was made in suggestions 4, 7 & 8 and an actual worsening was seen in goals 3 & 11. It is clear that the progress of the chemistry department would greatly enhanced by the increased support by the SSU campus.

F) Progress on departmental goals

Starting in Spring 2012 the chemistry department implemented chemistry 496 which is an elective taught in rotation by the chemistry faculty.

Starting in fall of 2008 the chemistry department started holding seminars during the fall semester in addition to the usual seminars held in the spring (Chem 497). Starting in 2010 the fall seminar series was formally made a course, Chem 492, which is available for any student to take for one unit

Starting in Fall 2012 the chemistry department started to offer a purely instrumental analysis course, Chem 275.

The department successfully acquired a new 400 MHz NMR (Major Research Instrumentation Acquisition. National Science Foundation. "MRI: The Acquisition of a 400 MHz NMR Spectrometer." $329,513. (2011)). In addition, two GC/MS instruments were donated to the department.

Here the SSU chemistry faculty have been extraordinarily successful having published 40 manuscripts since the previous program review.

The chemistry faculty have also been very successful in obtaining funding for their scholarly efforts. In total 49 grants have generated over 2,235,000 dollars of support.

Virtually all of the Chemistry Department's faculty have been active in presenting at conferences and other universities. In total 43 presentations have been made by Chemistry faculty since the last program review.

Even more so the students have been active in presenting work at conferences. In total **104** presentations have been made by Chemistry students since the last program review.

The chemistry department has been holding year-round department group meetings.

Since this program review the chemistry department has held regular, multi-day retreats every year. During these retreats details for course assessment, departmental goals, course learning objectives, curriculum improvements, and future directions were all laid out.

G) Lack of institutional support

I am very disappointed to point out that the departmental OE given to the SSU chemistry department is at the bottom of the compared CSU's by a substantial amount. Given that the average OE is $53,000 it is clear that this represents a significant problem.

I am disappointed to report that the start-up funds given to new SSU chemistry faculty is significantly on the bottom of all the compared CSU's. Considering that the average start-up package is $43,000 the SSU chemistry department is out of competition with other CSU's. This may present a problem with recruiting new faculty in the future.

In terms of the number of stockroom staff once again I am very sad to point out that the SSU chemistry department is at the very bottom of the compared CSU's. The average amount is 1.6 and SSU literally has half that with 0.8.

At the time of the previous program review the chemistry department had an instrument technician at 100% time. However, the current instrument technician is at only 50% time. This is unfortunate because an instrument technician is necessary for the maintenance, prepping, and repairs of the instruments used in chemistry teaching and research labs. Despite the fact that the number of teaching and research students has increased during the time of this program review, the number of technical staff has actually decreased.

The department's operating expense budget has not increased in the time since the previous review. Since the time of the previous review the faculty have gone to a typical teaching load of 9 unit to a typical load of 12 units. Virtually all of the chemistry faculty teach a unit overload each semester in order to supervise undergraduate researchers. Most research active CSU chemistry department's faculty teaches a 9 unit load to compensate for the time used in mentoring research students and writing grants.

Although there has been a constant call for increased ease in submitting grant proposals and more experienced personnel at the Contract and Grants office. Once again the general consensus is that the situation has gotten worse on both counts. The routing for grant proposals has gotten steadily worse. Currently, the proposal endorsement form (PEF) requires thirteen signatures. In particular, since the writing of the previous program review two new signatures, one from environmental health and safety, and one from police services, has been added to the PEF, thereby, making the process more difficult. It should be pointed out that the current SSU PEF and routing process is much more complicated compared to other CSUs.

Summary:

It is clear the chemistry department has done phenomenally well. The number of manuscripts published and the number of grants brought in are quite extraordinary. Also, the chemistry departments has been grown at a rate that is faster than SSU and CSU chemistry departments in general. It has been shown that almost all of our departmental learning outcomes are being met and almost all of our departmental goals were met. The evaluation of departmental SI's and the overall departmental SETE scores were very good.

The main problems appear to be institutional. The SSU chemistry department is clearly underfunded in terms of OE and Start-up funds for new faculty. Also, the chemistry department is understaffed in terms of stockroom staff. The SSU chemistry faculty were able to accomplish a phenomenal amount of scholarly activities despite not getting the three units of release time typical for research active chemistry departments. Lastly, the lack of a properly functioning ORSP has made writing and receiving grants very difficult.

7) 5-Year Action Plan: Fall 2015 – Fall 2020

The department of chemistry has discussed its five year review and held a summer retreat to determine the focus of the next five years.

A) Faculty

The department developed a five year hiring plan, a summary of which can be found in the Appendix. We determined an appropriate steady-state number of tenure track faculty, based on our current number of majors and FTES, would be 10 with the following subdiscipline coverage: 2 biochemistry (current), 1 analytical (current), 1 physical (current), 1 inorganic (current), 3 organic (2 current), 1 chemical education (0 current), and 1 materials (0 current).
This led us to a three-faculty hiring plan, hiring every other year for appropriate spacing. Based on our space availabilities and faculty expertise, as well as a need for more flexibility with our physical and analytical chemistry staffing, our first hire (slated for Fall 2015) would be in physical/analytical chemistry with an emphasis in materials/instrumentation/chemical education/computational chemistry. The next will be in organic chemistry with emphasis in materials/chemical education/computational chemistry, depending on the outcome of the first search.

We also discussed the need for coordination for both general chemistry and organic chemistry courses, primarily due to the high number of labs and overall large numbers of students. Faculty coordinating these lab courses would teach some of those courses and then have 3 WTU assigned time where they would be responsible for coordinating the additional adjunct faculty, training of new adjuncts, preparing the lab manuals and working with the stockroom for lab scheduling, working with the instrument technician to make sure instruments for each week were functional and prepared, coordinate the supplemental instructors and graders for the courses.

B) Curriculum:

We are currently in the process of assessing our latest curricular revisions that were implemented in Fall 2012 (as discussed earlier) as well as the freshman learning cohort. In addition, for the next five years we want to examine: the diverse curriculum of CHEM 401 to decide on the best teaching options for that course (individual vs team taught); team teaching and rotations in the freshman learning community as well as the on-sequence CHEM 115A course; the feasibility of two physical chemistry level course options for BA vs BS and how physical chemistry for biochemists should be considered (this is similar to the tracks of physics currently offered); the best use of the organic chemistry discussion period and where it should be located; the role of MATH 261 in our BS CHEM curriculum if we do not offer two distinct physical chemistry tracks and the possibility of replacing it with other elective support course options like calculus 3 or computer programming; and finally, revisiting the role of our BS capstone courses (CHEM 402 and 441) in light of our revised undergraduate research courses. cycling through the FLC and general chemistry

C) Investigation into a 4+1 MS program:

Over the years, the department has noticed that it has had a small number of graduates that have decided to pursue a PhD later during their academic career and are not prepared for graduate school. These students typically transfer to another CSU for a MS program or they remain at SSU volunteering while they build up their research experience and reapply. We have decided that keeping these students for an additional year and allowing them to continue their undergraduate research projects at a graduate level for completion of an MS degree is an appealing prospect and would serve these students well and serves a niche since it will be more affordable for students to stay in the area rather than move away. We plan to investigate this possibility further over the next five years, keeping in mind the following criteria and questions we need to address: 1) the MS program should enhance our undergraduate program by modeling behavior for undergraduates and raising the bar in cross-listed courses, 2) we are not large enough to offer significant MS level courses so do we have enough upper division courses to meet MS unit requirements with additional cross listing of some of our courses and other upper division courses in appropriate departments, 3) do TA-ships pay or do students receive units, 4) what is the departmental impact in terms of space, lower division lab coverage, faculty time (i.e. graduate committee commitments), 5) how will exit seminars fit into our current seminar series, 6) what are funding requirements, 7) what are funding requirements to be successful, 8) can students apply in their junior and senior year, and 9) what are selection criteria (finish research in one year and quailed to TA).

D) Scholarship

As mentioned earlier, the department has decided to pursue a 9+3 WTU teaching assigned with 3 WTU assigned directly for supervision and mentoring of undergraduates in research activities with faculty as well as scholarship related activities such as manuscript preparation and grant writing. As shown in the Appendix, the department has drafted a proposal to demonstrate cost saving measures we have already undertaken that support SST in terms of stream lining our research coursework and ideas to further support active research faculty. We will also be discussing better ways in which we can utilize our research resources through joint faculty projects and students, enabled through the CHEM 315/316 courses. Depending on the future directions of undergraduate research support, we may also have to revisit the department RTP policy for expectations regarding scholarly output.

E) Department size and course offerings

We have discussed our student body size and decided two lab sections in our FLC is enough for our incoming freshman class. Over the next five years we will need to consider impaction for this program with criteria based on chemistry in high school, GE math readiness, declaration of chemistry or biochemistry as their first choice of major. We want to focus on recruiting the right students into the FLC and retaining them. We have also decided to close for spring transfer students because the transfer at that point is not conducive to completion of our vertical curriculum. For our overall FTES, we are currently at maximum capacity and discussion of further offerings in the next five years would depend upon changes in space allocation and the presence of qualified instructors. However, we are interested in increasing our summer session offerings based on student need and will be considering possibilities for winter session such as organic chemistry lab if qualified instructors are available.

F) Space, Instruments, and Support Staff

To support new faculty hires we require three ~500 sq ft of wet lab space with hoods or computational support depending on the hire. Based on our current count of faculty offices (7 TT hallway offices, one 8 corner office, one basement adjunct office, one adjunct office shared with physics, and one office Carson Hall) we calculate a need for two more tenure track faculty offices. Addition of a full-time instrument technician to our department would require some workspace, such as the space currently used by the SST technician (and halftime by chemistry) in the Darwin basement. Given the stretched responsibilities of the stockroom technician, serving the stockroom, accepting deliveries, stocking labs in Darwin and Carson Halls), an additional 0.5 technician would also be appropriate. They would have space allocated in our current stockroom.

We also decided we need to work better with facilities over the next five years to make sure temperature in better modulated in Darwin 37 and 322, our instrument rooms. We also recognize a need to focus on instrument scheduling as our majors and FTES have grown. We will be investigating scheduling mechanisms such as color-coded calendars and online booking calendar programs.

G) Assessment

The department has decided to better streamline our collection of assessment data and to better utilize our AC for data storage. We have dedicated ourselves, over the next five years to: update and implement our alumni survey, move our exit exam to an online format, better track scores from the national American Chemical Society general chemistry exam, regularly collect faculty data including SETEs, FTES/semester, teaching assignments and enrollment, and to continue our yearly retreats where we focus on a main topic.

H) Outreach and development

After the success of the April 2014 chemistry of wine seminar, the department is dedicated to work towards an annual event with rotating topics of interest to continue to connect with our community. We plan to utilize either the Green Music Center or the Student Center to host speakers with expertise in topics including performance enhancing drugs, climate change, and infectious disease, and Nobel Prize winners.

I) Advising

In the past review cycle, the department focused advising efforts on the incoming freshman through the freshman learning community. With those methods established we plan to focus now on advising for transfer students. This includes developing a two year advising plan for transfers and making sure they are aware of SSU policies surrounding GPA requirements to stay in good standing. We also plan to increase our efforts to help the transfer students better incorporate into our department community.

For advising overall, we want to make sure students are more aware of departmental and SSU policies before they get into trouble, notably the department 3-repeat policy for courses and academic disqualification criteria as well as encouraging them to meet with their advisor and stick to the four year plan

8) Appendices

Appendix A

CV's of Full Time Faculty

Carmen F. Works

Department of Chemistry
Sonoma State University
1801 E. Cotati Ave
Rohnert Park, CA 94928
(707) 664-3084
carmen.works@sonoma.edu

EDUCATION

Ph.D. **Inorganic Chemistry** June, 2001
University of California, Santa Barbara

Dissertation Title: *Synthesis, Characterization, and Photochemistry of Ruthenium Nitrosyl Compounds for use as NO donors.*

M.S. **Inorganic Chemistry** June, 1998
University of California, Santa Barbara

B.A. **Chemistry** June, 1996
San Francisco State University
Cum Laude

B.A. **Psychology** June, 1996
San Francisco State University

PROFESSIONAL AFFILIATIONS

American Chemical Society 1996 – present

Counsel of Undergraduate Research 2003-2004

POSITIONS

Professor Chemistry Sonoma State University	
Associate Professor Chemistry Sonoma State University	2012-Present
Assistant Professor Chemistry Sonoma State University	2001-2012
Adjunct Professor Biology Sonoma State University	2002-Present
Adjunct Professor Chemistry Santa Barbara City College	1999-2001

TEACHING

TEACHING EXPERIENCE

Professor	Fall - 2012-Present
Associate Professor	Fall - 2007-2012
Assistant Professor	Fall - 2001 –2007

Department of Chemistry

Sonoma State University

Courses Taught at SSU

- General Chemistry I (Chem. 115A) Lecture (3 units), Lab (1 unit), Discussion (1 unit). Specific responsibilities included organizing the lecture, lab and discussion, teaching the lecture and sometimes the lab and discussions. Assessment of learning through exams, quizzes, lab reports, writing assignments, lab notebook and a cumulative final exam. 120 students is the maximum enrolled in the lecture and 24 is the maximum enrolled in each lab and discussion section.
- General Chemistry II (115B)
- Honors General Analytical Chemistry I (125A)
- Honors General Analytical Chemistry II (125B)
- Advance Inorganic Chemistry (Chem. 325). Lecture (3 unit) courses. Specific responsibilities included lecturing students on chemical reactions that involved inorganic molecules. Assessment of learning through exams, problem sets, group work and paper presentation.
- Research Methods in Chemistry (315) This course is designed to mentor undergraduate students in advancing their undergraduate research project through literature review, proposal writing and presentation of work through a final manuscript.
- Structural Biochemistry (445)
- Instrumental Analysis and Chemical Synthesis (401)
- Advanced Synthesis and Instrumental Analysis (Chem. 402) Lecture 1 unit (1 hour) and Lab 2 units (6 hours a week). Specific responsibilities included developing student

projects that incorporate all aspects of chemistry and work with students on individual project. This is a capstone course for the BS chemistry majors. Assessment of learning through weekly oral and written reports, midterm exam, final poster and final paper.

- Biochemical Methods (441)
- Research Seminar (497)
- Undergraduate Research (Chem. 494) Lab 1-6 units. Individual investigation of a chemical problem. Specific responsibilities included working with undergraduate research students on individual chemical problems. Assessment of learning and progress through daily meetings, weekly talks, and poster presentation.

Lecturer Fall 1999-Summer 2001

Department of Chemistry

Santa Barbara City College

Courses Taught

Introduction to Chemistry

General Chemistry I

General Chemistry II

Teaching Assistant Fall 1996 –Summer1998

Department of Chemistry

University of California, Santa Barbara

Labs Taught

General Chemistry I

General Chemistry II

General Chemistry III

Instructional Training Consultant Fall 1997 –Summer1998

Department of Chemistry

University of California, Santa Barbara

Responsibilities

Trained and supervised incoming graduate student teaching assistants for general chemistry

laboratories. Monitored and evaluated teaching

performance of first year graduate students.

Co-Instructor Summer 2001

Department of Chemistry

University of California, Santa Barbara

Taught advanced Inorganic Chemistry- graduate level course

Curriculum and Course Development

1. Research Course – spearheaded the redesign of SSU's chemistry undergraduate research course and experience. AY2010-2011
2. New Chemistry Curriculum-spearheaded the development of the chemistry curriculum for the BA in chemistry and the BS in both chemistry and biochemistry. Worked with the faculty to draft the curriculum for department, school and university approval. AY 2010-2011
3. Honors General and Analytical Chemistry- was responsible for the development and initial implementation. AY 2008-2009
4. General chemistry 115A and B – Selected textbooks, revised laboratory experiments. Coordinated lab, lecture and discussion components. Introduced writing assignments and lab reports. Active since 2001 to Present
5. Incorporation of Web CT in all courses. 2001-2010
6. Inorganic chemistry 325 – Selected textbooks, developed problem set, developed and coordinated group assignment, developed paper presentation assignment. Active since 2001 to Present
7. Synthesis and Characterization II. A Project Based Inorganic Lab Course. - Developed four project-based labs involving the synthesis of air, light and water sensitive compounds. These projects all involved the purification of inorganic and organic compounds and characterization of inorganic and organic compounds by spectroscopy. Active since 2001-Present
8. Biochemical methods – Co-Developed the project based biochemistry lab with Dr. Jennifer Lillig, SSU. 2004
9. Cooperative Learning Team - Developed the cooperative learning labs at UCSB in collaboration with Julie Rabor and Sandra Lamb. 1998

Academic Advising at SSU

During the time I have been at Sonoma State University I have taken on a variety of advising roles.

1. I am currently the lead advisor in the department and duties include assigning advisors to all of our majors, creating regular advising appointments, meeting with both transfer and freshman students to get them started in the major and communicating with prospective students.

2. I have been a mentor and advisor to all of the students that have conducted undergraduate research in my lab, and for many students doing undergraduate research in my colleague's labs.

3. I advise chemistry and biochemistry majors both in general education and the major. This requires either a meeting each semester or at least once a year with students individually, and includes the development of a four-year plan, progress reports, filling out graduation forms, and counseling students that are on probation or disqualification. This also includes career and graduate school advising.

4. I advise chemistry minors, including course work, graduation forms and general career advising.

5. I have advised the incoming freshmen students at SOAR summer 2010, and summer 2009.

6. I have advised transfer students several times since 2001, and continue that role.

7. I regularly advise chemistry minors and this includes a minor plan, progress reports, graduation forms, and career advising.

8. I write several letters of recommendation during the academic year and summer months for majors, minors, pre-health students and other students.

9. I have been an active participant in a team of chemist that track our alumni

HONORS RECOGNITIONS AND AWARDS

Sabbatical Award	Spring 2011
Excellence in Teaching Award at SSU	AY 2008-2009
Nomination, Excellence in Teaching Award at SSU	04, 05 and 06
Recognized by the Society of Toxicology for my role as a faculty mentor to minority students in science	2009
Recognized by the Freshman Interest Group for my role as a teacher, mentor and role model	2006
Honored by The Associated Students of Sonoma State University for my contributions to their education	2009
Honored by Expanding Your Horizons for my contribution to their program	2002,03,04, 05,06,07,08
Honored by the Chemistry Club at Sonoma State University for my role in advising	2002
Graduate Opportunity Fellowship. $10,000.00 This fellowship is awarded to graduate students that have overcome difficulties to pursue an advanced degree.	1999-2000
California State University Research Competition: First place campus wide, Second place statewide. Title: Synthesis, Purification and Characterization of a Rhenium Carbonyl Compound	Spring 1996
Women and Minority Program for Graduate Education (WMPGE). This award was for a summer internship and preparation for graduate studies. $3,500.00 for GRE classes and $500.00 for research supplies.	Summer 1995

SCHOLARSHIP

RESEARCH EXPERIENCE

Principal Investigator Fall 2001 - present

Sonoma State University
1. Investigation of the importance of proteins in the role of detoxification of chromium(VI). My research at SSU has shown that chromium (III) can form protein complexes. My working hypothesis is that these chromium (III) proteins are formed to prevent chromium (VI) from reacting with DNA, as a possible detoxification mechanism. In order to determine if these chromium (III) protein complexes serve a detoxification role, I have designed experiments to isolate and study the chromium (III) proteins that form in bovine liver after exposures to chromium (VI). In order to understand the function of these metallo-proteins, their structural information must first be determined, which is the long-term goal of my research in this area.

SSU Supervised Research Students

- Mark Francisco 2001-2003- local industry
- Megan Cook 2001-2002 – High School Chemistry Teacher
- Jessica Bender 2002-2003 – Medical Doctor
- Thelma Garcia 2002-2004 – Ph.D. Scientist
- Kelly Banker 2004-2005 – Pharmacy School
- Ryan Peterson 2004-2006 – Ph. D. Candidate John's Hopkins University
- Krista Prescott 2005 – 2007 - NA
- Shannon White 2005- 2009 – Employed in local industry
- Sara Spect 2007 - NA
- Judi Knect 2007 – 2008 – Employed in local industry
- Jena Bernard 2008- 2010 – Graduate Student UC Berkeley
- Bernice Wright 2008-2011 – Pharmacy School
- Destinie Hill 2009- 2010 - NA
- Melissa Smith 2009 – Employed in local industry
- Juan Sosa 2009- present
- Kanta Dugh 2009 - Medical School
- Shannon O'Hare 2009 – local industry
- Gabriel Schrock – 2011-2012 employed in local industry
- Kim Trevino – 2011- present
- Carmen Dullaart –2011- 2012 Pharmacy School
- Hank Seeley – 2011- present – accepted to graduate school 2014

2. Investigation of the role of bacteria in bioremediation of polluted soil and water from chromium(VI). The chromate reductase project is concerned with studying the mechanisms that some bacteria utilize to live in high chromium (VI) environments. I am particularly interested in

bacteria that can reduce toxic chromium (VI) to the less toxic chromium(III) form. This reduction process can only occur through a catalyzed reaction pathway, utilizing a type of enzyme called chromate reductase. My research group at SSU has identified a new bacteria, *Pseudomonas Veronii* that is capable of reducing chromium (VI), indicating the presence of a chromate reductase.

SSU Supervised Research Students

- Dana Skarra 2002-2005 – Ph.D. Scientist
- Elizabeth Streans 2004-2008 – Employed in local industry
- Mohammad Ali Roohian 2005 – Employed in local industry
- Daniel Pritchard 2006 – 2009 – Ph.D. Student U of A
- Michelle Stewart 2006 – 2007 – lab tech at SRJC
- Amanda Burrnett 2007 – MS in biochemistry
- Jessica Ignitius 2007 – 2008 MS program
- Rosemary Mutunga 2008
- Melissa Herland 2008-2009 – Employed in local industry
- Mollie Haley 2008 – 2009 – Medical School
- SaraLynn Thompson – 2009-2013
- Melanie Lomotan 2010-2011 – Employed in local industry
- Sarah Perrin 2011-2013 Medical School Turo
- Heidi van de Wouw 2010- 2012 – Johns Hopkins
- Anthony Gamboa 2012-present
- Benna Njau 2012-present

3. Investigation into the photochemistry of the reactivity of μ-(1,3-propanedithiolato)-hexacarbonyldiiron. This compound is a structural and functional model for the active site of iron-only hydrogenase. The photochemical experiments in this project could lend insight into how bacteria use hydrogen as a fuel.

SSU Supervised Research Students

- Marci Peralto 2002-2003 – Medical Doctor
- Jennifer Harr 2003-2005 – Ph.D. Student, John's Hopkins
- Nicole Martineau 2004
- Jessica McDonald 2006 – 2008 – Ph.D. Student, UCSB
- Seth Berg 2006-2008 – law school
- Melanie Lotoma 2008-Present – Employed in local industry
- Melinda Davis 2008-present – Employed in local industry, grad student SD
- Haley King 2009-present – applying to vet school
- Peter Damon –2013 – visiting scholar – graduate school UCSB
- Jacob Barrett – 2012-present accepted to graduate school
- Yasmine Fathi – 2013- present
- Jaimie Homen – 2013- present
- Brianna Dearing – 2012-present

Graduate Research Assistant November 1996 – July 2001

University of California Santa Barbara

Advisor: Dr. Peter C. Ford

This project was concerned with the development of ruthenium nitrosyl compounds for use as anti cancer drugs. Two of the compounds were sent to the NIH for testing

Detailed mechanism of nitric oxide interaction with transition metals was determined using laser flash photolysis, kinetics, and continuous wave photolysis. Compounds were characterized using optical, NMR, and IR spectroscopy and electrochemistry.

Undergraduate Research Assistant June 1995 – July 1996

San Francisco State University
Advisor: Dr. Jane Zeile

This project involved the synthesis and characterization of bimetallic catalysts for use in heterogeneous catalysts. Compounds were characterized using IR and NMR spectroscopy.

SCHOLARLY OUTPUT

Peer-Reviewed Refereed Publications

1. Advance Inorganic Lab Experiment: Synthesis and Characterization of μ-$S_2Fe_2(CO)_6$. Barrett, J. Spentzo, A., **Works, C**. *Journal of Chemical Education* submitted **2013**.

2. Flash Photolysis and Continuous Photolysis of an Iron-Iron Hydrogenase Model (μ-pdt)$[Fe(CO)_3]_2$ in Different Solvents; Insight into the Inhibition by CO. Marhenke, J.; Pierri, A.; Lomotan, M.; Ford, P.C. *Inorganic Chemistry* **2011**, 50 (23) 11850-11852.

3. Oxidation of Chromium(III) Binding Proteins and Implications for Insulin Activity in Glucose Metabolism. White, S.A., **Works, C.F**. *Journal of Undergraduate Chemistry Research* **2010**, 9(2) 36-38.

4. Photochemical studies of iron-only hydrogenase model compounds Brown-McDonald, J., Berg, S., Peralto, M., **Works, C** *Inorganica Chimica Acta* **2009**, 362, (2) 318-324.

5. Isolation of a Novel Chromium(III) Binding Protein from Bovine Liver Tissue After Chromium(VI) Exposure. Ryan L. Peterson, Kelly J. Banker, Thelma Y. Garcia, and **Carmen F. Works**. *Journal of Inorganic Biochemistry*. **2008** (102) 833–841.

6. Synthesis, Purification and Characterization of a μ-(1,3-propanedithiolato)-hexacarbonyldiiron: Laboratory Experiment or Mini-Project for Inorganic Chemistry or Integrated Laboratory. **Works, C.F**. *J. Chem. Ed.* **2007** (84) 836.

7. Purification of a chromate reductase from a pseudomonad**.** Skarra, D.V. and **Works, C.** *Preprints of Extended Abstracts, American Chemical Society*, *Division of Environmental Chemistry* **2005**, 45(1), 461-466. Presented at the ACS National Meeting in San Diego.

8. Photochemical Nitric Oxide Precursors: Synthesis, Photochemistry, and Ligand Substitution Kinetics of Ruthenium Salen Nitrosyl and Ruthenium Salophen Nitrosyl Complexes **Works, C. F**.; Jocher, C. J.; Bart, G. D.; Bu, X.; Ford, P. C. *Inorg. Chem*. **2002,** *41*(14), 3728-3739.

9. Reactions of Nitrogen Oxides with Heme Models. Characterization of NO and NO_2 Dissociation from Fe(TPP)(NO_2)(NO) by Flash Photolysis and Rapid Dilution Techniques: Fe(TPP)(NO_2) as an Unstable Intermediate. Lim, M.D.; Lorkovic, I.M; Wedeking, K; Zanella, A.A.; **Works, C.F.**; Massick, S.M.; Ford, P.C. *J. Am. Chem. Soc* **2002**, 124(33), 9737-9743.

10. Photoreactivity of the Ruthenium Nitrosyl Complex, Ru(salen)(Cl)(NO). Solvent Effects on the Back Reaction of NO with the Lewis Acid Ru(III)(salen)(Cl) **Works, C. F**. and C. Ford, P.C. *J. Am. Chem. Soc*. (**2000**), *122*(31), 7592-7593

Manuscripts in preparation

11. Identification and Characterization of a Chromate Reducatase from *Pseudomonas Veronii.* Skarra D.V. and **Works C.F.** Manuscript in Progress for Journal of Environmental Science and Technology. **Prepared Summer 2013**

Peer Reviewed Published Abstracts

1. Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts.; Prescott, K.T.; White, S.; **Works, C.F.** Abstracts of Papers, 2006, CHED-0273. Presented at the 232rd ACS National Meeting in San Francisco

2. Chemistry day outreach program for elementary school students. Prescott, K.; Lillig, J.W.; Banker, K.J.; Mulvihill,

M.; Cucci, A.; Peterson, P.L.; Foust, J.; **Works, C.F**.; Sterns, E. Abstracts of Papers, 2006, CHED-0376. Presented at the 232rd ACS National Meeting in San Francisco

3. Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure. Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** Abstracts of Papers, 2006, INOR-0875. Presented at the 232rd ACS National Meeting in San Francisco

4. Investigation of a chromate reductase in a Psuedomonas *veronii* bacteria cell. Stewart, M.A.; Skarra, D.V.; Works, C.F. Abstracts of Papers, 2006, BIOL-0235. Presented at the 232rd ACS National Meeting in San Francisco*

5. Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure. Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** Abstracts of Papers, 2006, CHED-0883. Presented at the 231st ACS National Meeting in Atlanta

6. Photochemical studies of a model compound for iron-only-hydrogenase. Harr, J; Martineau, N.; **Works, C. F.** *Abstracts of Papers*, **2005**, CHED-1065. Presented at the ACS National Meeting in San Diego

7. Isolation and characterization of a chromium peptide from bovine liver. Banker, K.J; Peterson, R.L.; **Works, C.F.** *Abstracts of Papers*, **2005** CHED-1048. Presented at the ACS National Meeting in San Diego

8. Isolation and Characterization of a Chromium Peptide from Bovine Liver. Peterson, R. L.; Banker, K.J.; Garcia, T.; **Works, C.F.**. *Abstracts of Papers*, **2004**, GEN-181. Presented at the ACS Regional Meeting in Sacramento.

9. Photochemical Studies ofa Model Compound for Iron-only-Hydrogenase. Martineau, N.; Harr, J.; **Works, C**. *Abstracts of Papers*, **2004**,GEN-163. Presented at the ACS Regional Meeting in Sacramento.

10. Purification of a Chromate Reductase from a Pseudomonad. Skarra, D. V.; **Works, C.F**. *Abstracts of Papers*, **2004**, GEN-030. Presented at the ACS Regional Meeting in Sacramento.

11. Isolation and characterization of chromium (VI) tolerant soil Bacillus. Skarra, D. V.; **Works, C. F**. *Abstracts of Papers*, **2004**, CHED-409. Presented at the ACS Regional Meeting in Sacramento.

12. Efficiency of transferrin as a chromium transport protein. Garcia, T.Y.; Skarra, D.; **Works, C.F**. *Abstracts of Papers*, **2003**, CHED-395. Presented at the ACS National Meeting in Anaheim.

13. Kinetic analysis of transferrin with chromium(III) salts**.** Skarra, D. L..; Cook, M. R.; **Works, C.F.** *Abstracts of Papers*, **2003**, INOR-149. Presented at the ACS National Meeting in Anaheim.

14. Enhancing glucose transport rates in fibroblasts with a biomimetic of a chromium binding peptide. Francisco,

M.S.; **Works, C. F**. *Abstracts of Papers*, **2003**, INOR-024. Presented at the ACS National Meeting in New Orleans

15. Synthesis, characterization, and photophysical studies of some ruthenium salen nitrosyl compounds: Potential NO delivery agents and mechanistic insights in catalytic behavior. **Works, C. F**.; Jocher, C.; Ford, P. C. *Abstracts of Papers*, **2001**, INOR-712. Presented at the ACS National Meeting in San Francisco

16. Formation and reactivity of the elusive species Fe(Porphyrin)NO_2. Wedeking, K.; Lorkovic, I. M.; **Works, C. F**.; Ford, Peter C. *Abstracts of Papers*, **2001**, INOR-139. Presented at the ACS National Meeting in San Francisco

12. Photochemistry of ruthenium nitrosyl schiff base compounds**.** **Works, C. F**.;

Bart, G.D.; Ford, P.C. *Book of Abstracts*, **2000**, INOR-706. Presented at the

ACS National Meeting

13. Photochemistry of ruthenium (II) Schiff base nitrosyl compounds. **Works, C.F**.;

Bart, G. D.; Ford, P.C. *Book of Abstracts,* **1999***,* INOR-164**.** Presented at the ACS

National Meeting

Citations of published abstracts and published papers

1. Factors affecting the conformational preference and magnetic shielding of isobutenylene chains in macrocyclic salicylideneaniline derivatives
Houjou H (REPRINT) ; Tsuzuki S; Nagawa Y; Kanesato M; Hiratani K. *BULLETIN OF THE CHEMICAL SOCIETY OF JAPAN , 2003 , Volume: 76 , Number: 12 (DEC) , Page: 2405-2411 , December 2003*

2. Control of NO release by light irradiation from nitrosyl-ruthenium complexes containing polypyridyl ligands
Sauaia MG; Oliveira FD; Tedesco AC; da Silva RS. *INORGANICA CHIMICA ACTA , 2003 , Volume: 355 (NOV 20) , Page: 191-196 November 20 2003*

3. A ruthenium nitrosyl that rapidly delivers NO to proteins in aqueous solution upon short exposure to UV light
Patra AK; Mascharak PK. *INORGANIC CHEMISTRY , 2003 , Volume: 42 , Number: 23 (NOV 17) , Page: 7363-7365 , November 17 2003*

4. Iron nitrosyls of a pentadentate ligand containing a single carboxamide group: Syntheses, structures, electronic properties, and photolability of NO
Patra AK; Rowland JM; Marlin DS; Bill E; Olmstead MM; Mascharak PK. *INORGANIC CHEMISTRY , 2003 , Volume: 42 , Number: 21 (OCT 20) , Page: 6812-6823 , October 20 2003*

5. Reaction of acetone on coodinated nitrile in beta-diketonato ruthenium complex, [Ru(acac)$_{(2)}$(CH_3CN)$_{(2)}$)] with the formation of beta-ketiminate
Hashimoto T; Hara S; Shiraishi Y; Natarajan K; Shimizu *CHEMISTRY LETTERS 2003 , Volume: 32 , Number: 9 (SEP 5) , Page: 874-875, September 05 2003*

6. Synthesis and photophysical properties of new chromium(III) complexes of N-derivatized 1,4,8,11-tetraazacyclotetradecane ligands cis-[Cr(1,8-R(2)cyclam)Cl-2]Cl, where R is a pendant chromophore. Exclusive formation of the cis isomer
   DeRosa F; Bu XH; Ford PC *INORGANIC CHEMISTRY , 2003 , Volume: 42 , Number: 13 (JUN 30) , Page: 4171-4178 , June 30 2003*

7. Photochemical investigation of Roussin's red salt esters: Fe-2(mu-SR)(2)(NO)(4)
   Conrado CL; Bourassa JL; Egler C; Wecksler S; Ford PC. *INORGANIC CHEMISTRY , 2003 , Volume: 42 , Number: 7 (APR 7) , Page: 2288-2293 , April 07 2003*

8. The reactivity of nitrosyl ruthenium complexes containing polypyridyl ligands
   Sauaia MG; da Silva RS
   TRANSITION METAL CHEMISTRY , 2003 , Volume: 28 , Number: 3 (APR) , Page: 254-259 , April 2003

9. H-1 NMR and electrospray mass spectrometry of the mono-ionized bis(2,2 '-bis(4,5-dimethylimidazole)chloronitrosylruthenium(II) complex ([Ru(NO)Cl(LH2)(2)](+), LH2=2,2 '-bis(4,5-dimethylimidazole)
   Stringfield TW; Somayajula KV; Muddiman DC; Flora JW; Shepherd RE. INORGANICA CHIMICA ACTA , 2003 , Volume: 343 (JAN 30) , Page: 317-328 , January 30 2003

Conference Contributions

1. "Chromium(III) binding to glutathione and transferrin." Hank Seeley and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

2. "The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs" Jacob Barrett and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

3. "Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$" Jaimey Homen, Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

4. "Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents." Talk- Carmen Works, 245rd National ACS Meeting, New Orleans, LA., 2013.

5. "The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs" Jacob Barrett and Carmen Works, NCUAC –talk Spring 2013.

6. "Binding Studies of Chromium(III) to glutathione and transferrin." Hank Seeley and Carmen Works, NCUAC –talk Spring 2013.

7. Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$" Jaimey Homen, Carmen Works, NCUAC –poster Spring 2013.

8. "Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents." Poster -Heidi van de Wouw, Peter Damon and Carmen Works, 243rd National ACS Meeting, San Diego CA, 2012.

9. “Quantum Yield Determinations of Iron-Iron Hydrogenase Model Compounds” Heidi van de Wouw and Carmen Works, talk, NCUR Symposium, Spring 2012.

10. “Isolation and Characterization of a Novel Chromium Binding Protein” J. Bernard and C. Works, CSU Student Research Competition, 2011.

11. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. CSU Student Research Competition, 2011.

12. “Photochemical Studies of Iron-Only Hydrogenase.” M. Pope and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

13. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

14. “Investigation for the Bioremediation of Chromium(VI) Using Pseudomonas veronii.” M. Herland, M. Haley, C. Works. 22nd Annual CSUPERB Symposium 2010.

15. “Characterization of a Chromium-Binding Protein.” J. Bernard, B. Wright, D. Hill and Carmen Works, 22nd Annual CSUPERB Symposium 2010.

16. “Photochemical Studies of an Iron-Only Hydrogenase” M. Pope, M. Lomotan, H. King and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010.

17. “Characterization of a Chromium Binding Protein” J. Bernard, B. Wright and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010

18. “Isothermal Calorimetric Studies of Chromium(III) with Various Ligands” N. Trimble and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010.

19. “Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Benard, J. Wright B., Hill, D., Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

20. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

21. “Evaluation of the Bacteria Growth of P. Verrnoii” Haley, M., Herland M., and Works C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

22. “Photochemical Studies of Model for Iron-Only Hydrogenase” Lomotan, M., Davis, M., Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

23. “Photochemical Studies of Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. SSU Faculty Expo Spring **2008**.

24. "Photochemical Studies of a Model for Iron-Only Hydrogenase" McDonald, J. Works, C.F. 20t Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

25. "Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure." Benard, J. Wright B., Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

26. "The Analysis of the Enzymatic Reduction of Chromium" Pritchard, D.C. and Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

27. "Interaction of Chromium(III) with EDTA" Dugh, K. and Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

28. "Effects of Chromium(III) Binding Proteins on PTPase Activity" 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

29. "The Analysis of the Enzymatic Reduction of Chromium" Pritchard, D.C. and Works, C.F. 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

30. "Photochemical Studies of a Model for Iron-Only Hydrogenase" McDonald, J. Works, C.F. 19t Annual Northern California ACS Undergraduate Research Meeting Sonoma May **2008**.

31. "Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure." Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** SSU Faculty Expo Spring **2006**.

32. "Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts." Prescott, K.T.; White, S.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

33. "Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure." Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

34. "Reactivity of Chromium(III) with Biological Molecules." E. Sterns and **C.F. Works** 18th Annual Northern California ACS Undergraduate Research Meeting. SJSU, San Jose CA May **2006**.

35. "Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts." Prescott, K.T.; White, S.; **Works, C.F.** CSUPERB San Jose, CA January **2006**.

36. "Reactivity of Chromium(III) with Biological Molecules." E. Sterns and **C.F.** CSUPERB San Jose, CA January **2006**.

37. "Isolation and Characterization of a Chromium Peptide from Bovine Liver." R. Peterson, K. Banker, and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

38. "Purification of a Chromate Reductase from Pseudomonad." D. Skarra and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

39. “Photochemical Studies of a Model Compound for Iron-Only-Hydrogenase.” J. Harr and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

40. “Reactivity of Chromium(III) with Biological Molecules.” E. Sterns and **C.F. Works** 17th Annual Northern California ACS Undergraduate Research Meeting. Mills College, Oakland CA April **2005**.

41. “Efficiency of Transferrin as a Chromium Transport Protein.” CSUPERB San Jose, CA January **2004**.

42. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” T. Garcia and **C.F. Works** CSUPERB San Jose, CA January **2004**.

43. “Biological Transport of Chromium(III) ions.” **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

44. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” D. Skarra and **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

45. “Kinetic Studies of the Reaction Between Chromium(III) and Transferrin.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

46. “Synthesis, Purification and Photochemical Studies of a Model Compound of the Iron-Only Hydrogenase Enzyme.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

47. “Probing MetalloProteins with Electrochemistry.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

48. “Kinetic Studies of Chromium(III) salts with apo-Transferrin in buffered aqueous solutions.” M.R. Cook and **C.F. Works** 14th Annual Northern California ACS Undergraduate Research Meeting. San Jose State University, CA 2002.

49. “Photochemistry of Ru(Salen)(NO)(X) compounds.” *Southern California Inorganic Photochemistry Conference*. Catalina Island, CA **1999, 1998, and 1997**.

Invited lectures

Photochemistry of Iron-Iron Hydrogenase Model Compounds Department Seminar San Francisco State University	Spring 2013
Photochemistry of Iron-Iron Hydrogenase Model Compounds Department Seminar Sacramento State University	Spring 2011
Isolation and Characterization of Chromium(III) Binding Proteins Department seminar Department of Chemistry and Biochemistry UCSC	Fall 2009
Research and Graduate Experience Minority recruitment UCSB	Spring 2009
Isolation and Characterization of Chromium(III) Binding Proteins Department seminar Department of Biology SSU	Fall 2008
Isolation and Characterization of Chromium(III) Binding Proteins Department seminar Chemistry and Biochemistry San Jose State University	Fall 2008
Isolation and Characterization of Chromium(III) Binding Proteins Department seminar Chemistry and Biochemistry University of California, Santa Barbara The Chemistry of Metals in Biological Systems. Provost Lecture Series Sonoma State	February 2006 April 2004
The Biological Importance of Chromium(III) Ions. Department seminar Chemistry at Chico State University	November 2003
Transition Metals in Biology: Is Chromium (III) Essential? Department seminar Biology at Sonoma State University	May 2003
The effects of chromium on the structure and function of LMWCr binding protein Department seminar Chemistry and Biochemistry at San Francisco	May 2002

State University	
Photoreactivity of the Ruthenium Nitrosyl Complex, Ru(salen)(Cl)(NO). Solvent Effects on the Back Reaction of NO with the Lewis Acid Ru(III)(salen)(Cl) Department seminar for Chemistry and Biochemistry at Fresno State University	May 2001

Grant Proposals

1. PI-NSF REU STAR Science Transition Training and Research $276,045: PENDING — 2011

2. PI-CSUPERB Research Development A Biological Fuel Cell: Iron-Only Hydrogenase. Understanding the Catalytic Details. $12,842. NOT FUNDED — 2011

3. PI-CSUPERB Program Development: Creation of a Learning Community for the Training of Ethical Research Scientists from the Community College to the CSU, $15,000. NOT FUNDED — 2011

4. PI-ACS-PRF Photochemical Studies of Dinuclear Iron Complexes for the Activation of Molecular Hydrogen, $65,000. PENDING — 2011

5. **Co-PI NSF-MRI- Acquisition of a high field NMR $349,058. FUNDED — 2011**

6. **PI – NSF RUI Funding for Iron-only hydrogenase project. $ 130,673. FUNDED AT $129,754. JULY 2011 — 2011**

7. PI-NSF REU CHEERS program to create summer research opportunities for undergraduate students. $223,770. ~~Pending~~ not funded — 2010

8. Co-PI NSF-MRI- Acquisition of a high field NMR $349,058. NOT FUNDED — 2010

9. Faculty Mentor - SSU student stipends in the amount of $750 to support — 2010

undergraduate research. FUNDED $500

10. Faculty Mentor - SSU student stipends in the amount of $750 to support undergraduate research. FUNDED $500 2010

11. Faculty Mentor – CSUPERB Howell for $3000, not funded 2010

12. PI – NSF RUI Funding for Iron-only hydrogenase project. $ 129,673. Not Funded 2009

13. PI-NSF REU CHEERS program to create summer research opportunities for undergraduate students. $223,770. Not Funded 2009

14. PI – NIH AREA - Funds for Chromium Binding Protein Project. $150,000, Not Funded 2009

15. Co-PI NSF-MRI- Acquisition of a high field NMR $349,058. Not Funded 2009

16. Faculty Mentor - SSU student stipends in the amount of $500 to support undergraduate research. FUNDED $500 2009

17. Faculty Mentor – CSUPERB Howell Research Scholar for $3000 2009. Not Funded 2009

18. Faculty Mentor - SSU student stipends in the amount of $500 to support undergraduate research. FUNDED $500 2008

19. PI-NSF REU – CHEERS program to create summer research opportunities for undergraduate students. $349, 058. Not Funded 2008

20. PI – NIH AREA – Funds for Chromium Binding Protein Project. $150,000, Not Funded 2008

21. MRI: The Acquisition of a High Field NMR Spectrometer and a Liquid Chromatography / Mass Spectrometer. $642.084. Not Funded. 2008

22. PI – ACS-Petroleum Research Fund Type B grant for $55,000. Not Funded 2006

23. Co-PI- NSF CCLI grant for the development of general chemistry lecture and lab. $149,92. not funded 2006

24. PI – Faculty Seed Grant CSUPERB for $15,000. FUNDED for $10,000. 2005

25. Faculty Mentor - SSU student stipends in the amount of $500 to support undergraduate research. 2005

26. PI – MERCK AAAS Undergraduate Science Research for $60,000. NOT FUNDED. 2005

27. Collaborator, "Acquisition of a MALDI-TOF MS System for the College of Natural Sciences and Mathematics, California State University Long Beach." Keck Foundation. FUNDED $724,131 2005

28. PI - RSCAP mini grant sponsored programs for support of undergraduate research. SSU. FUNDED $2,000 2005

29. Faculty Mentor - Howell-CSUPERB young investigator Award for undergraduate research. FUNDED $2,500 2005

30. Faculty Mentor – Tri-beta undergraduate research award for FUNDED $300 2004

31. PI – MERCK AAAS Undergraduate Science Research. NOT FUNDED $60,000 2004

32. PI - RSCAP mini grant SSU office of sponsored programs for support of undergraduate research during the summer. $4,200. Funded 2003

33. PI - Petroleum Research Foundation for $30,000. Not Funded 2003

34. PI - for CSUPERB grant for curriculum development in the amount of $15,000. FUNDED 2003

35. PI - RSCAP summer stipend in the amount of one-month salary to support summer research. Funded 2003

36. Co-PI NER: Self assembled protein-phospholipid tubules for light sensor arrays. $ 128,853. Not Funded — 2003

37. Faculty Mentor - Howell-CSUPERB young investigator Award for undergraduate research. $2,500. Funded — 2003

38. Co-PI NSE-NIRT: Use of Near Field Scanning Optical Microscopy and Atomic Force Microscopy in Interdisciplinary Research and Curriculum Development. $2,428,287.00. Not Funded — 2002

39. Co-PI NER: Protein Based Self-Assembled Biophotonics Detectors. $99,121. Not Funded — 2002

40. PI – Research Corporation $35,150. Not Funded — 2002

41. Faculty Mentor - SSU student stipends in the amount of $500 to support undergraduate research. — 2002, 2001

OTHER SCHOLARLY ACTIVITIES

SOT conference – Attended as a faculty mentor with two SSU undergraduates	Sp 2009
Peer review Article for the Journal of Chemical Education	2009
Peer review Article for the Polyhedron	2008
Peer reviewed Article for Chemical Toxicology	2008
Peer review faculty seed grants for CSUPERB	Fall 2008
Consulting for Red Hill Studios. Contracted by Red Hill Studios to develop online technology.	2006
Advisor of Dana Skarra who received her Masters degree in Biology Summer of 2005. Thesis Tile: Identification and Characterization of a Chromate Reducatase from *Pseudomonas Veronii.*	2002-2005

Peer Reviewer for Journal of Bioinorganic Chemistry This is a top journal in the area of bioinorganic chemistry and I was picked to be a peer reviewer for a paper on the bioinorganic chemistry of chromium. In this paper the PI was making small chromium compounds and studying their reactivity with DNA.	Fall 2004
Faculty Writing Group – This group consisted of faculty from across the campus that got together bi-weekly to discuss faculty writing. I read writing from several faculty members, provided comments and participated in discussion. In addition I provided a draft of a grant proposal I had been working on for the NIH, for other faculty to read and provide feedback.	Fall 2004
Attended the Gordon Conference on Metals in Biology	Jan. 2003
Consultancies Allerderm Laboratories, development of a qualitative test for the presence of cobalt	Oct. 2001

SERVICE

SERVICE TO THE UNIVERSITY

Department Committees and Service	
• Department RTP Committee – member and chair	2008 and 2009
• Chair of Department Search Committee - Fall 2007 the Department of Chemistry conducted two tenure track searches. The first was in the area of organic chemistry and the second was in the area of analytical chemistry. This resulted in the successful hiring of one organic chemist. The second search was canceled due to budget cuts. • Member Search Committee Last year was my third year on a search committee. I screened initial applications. I completely reviewed all components our first screen of about 40 candidates for two positions. I phoned references. I was responsible for helping the 8 final candidates with AV needs for their visit to campus. I attended all the mock teaching sessions, and research seminars. I had lunch or dinner with all of the candidates that came to campus.	2007

	2003-2004 2004-2005 2005-2006 2007 2008
• Co-Developer, B.S. Biochemistry Degree	2004-2005
• Chair, Full Time Temporary Search Committee. Even though I had been a member of three search committees this was the first time I was responsible for filling out all of the forms involved in the hiring process. I also organized interviews.	Spring 2005
• Member, Curriculum Committee	2001 - present
• Library Liaison	2001-present
• Academic Advisor, Chemistry Majors and Minors – see advising under teaching.	2003 - present
• Member, Scholarship Committee. The chemistry department scholarship committee meets every spring and we read all of the scholarship application from chemistry majors. We are responsible for Thermochem ($1,000) and Rhodyne ($500) awards. In addition we have a foundation and we give money to other scholars that are chemistry majors based on their application.	2001-present
• Recruiter, Chemistry Department	2001- present
• Santa Rosa Junior College Liaison	2001 - present
• Organizer, Student Faculty Seminars	2003 -2004
• Advisor, Chemistry Club	2001-2003.

School Committees and Service

- Member, Radiation Safety Committee 2002 - 2008
- Alternate Member, Darwin Transition Committee Spring 2005
- Alternate Member, Strategic Planning Committee Spring 2005
- Member, MESA 2002 -present
- Member, Thesis Committee for Biology Student Kristy Deiner 2002
- Presenter, War and Peace Lecture Series 2002

University Committees and Service	
• Summer Orientation Advisor • Member of screening committee for the Director of Undergraduate Studies • Member of the Dean Review Committee for Dean Rahimi • Chair EPC • Executive Committee - member • Academic Senate – member • GE sub committee – liaison • Contributor to GE program Review and the development of GE area Learning Outcomes • Contributor to WASC coordination and visitation • Member, Faculty Standards and Affairs (FSAC). During the last year of FSAC I contributed to the development of several faculty policies. During this time FSAC finished the course outline policy, the endowed chairs policy, and excellence in teaching award policy. In addition we started to develop a hiring policy and re-structure the university RTP policy.	2010 2010 2009 Fall 2008 and AY2009-2010 Fall 2008 and AY2009-2010 Fall 2008 and AY2009-2010 2009-2010 2008-2009 2009 2007 and 2009 2003-2006
• Member, Educational Policies Committee (EPC). During my first year as a member of EPC, I had the opportunity to be a part of many educational policy decisions and learn a lot about the structure of the university. During this time EPC worked on program review policy, course withdrawal policy, course outline policy, the freshman year experience proposal, and service learning. In addition we had many guest attend the meetings with course change requests or major change request.	2004-2007

- MESA DAY contributor 2011
- Expanding Your Horizons (EYH)- Organized the Parent Workshop 2010
- Faculty Advisor, SSU Rotary Club 2004-2005
  Participated in bi-weekly meetings with SSU students to organize community service events. Participated in the restoration of hiking trails in Helen Putnam Park.
- Expanding Your Horizons (EYH) 2004, 2005 2006
  Created and lead a workshop with Jennifer Lillig (SSU) titled: "Watch out for the Bath Bombs". Also volunteered to escort girls to the workshops and bring supplies.
- National Chemistry Week Co-Organizer 2001, 2002, 2003, 2004 2005
  Each year I participate in organizing demonstrations, and food for the community. Members of the community come to SSU and are introduced the microscopic world of chemistry through hands-on events. Last year I coordinated the periodic table of cupcakes and hydrogen balloon blow out.
- Co-created and organized of a lab for Girl Scout Troop 2004
  Organized and hosted a laboratory day entitled "Chemistry of Foods and Cleaners- Is it an acid or is it a base?" Designed to introduced the troop to the chemistry of household products.
- Contact to Biosearch Technologies 2002
  I made two visits to the laboratories and took one tour. Went to lunch with the CEO and senior research scientist. Hosed the senior research scientist at SSU where she gave a talk and went to lunch with students.
- Site visit BioMarine Laboratories 2002
  I accompanied several locate educators to BioMarine laboratories and we took a tour and had dinner.

Curriculum Vita

Jennifer Whiles Lillig

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Rohnert Park, CA 94928

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Fax: 707-664-3012

E-mail: Jennifer.Whiles@sonoma.edu

EDUCATION

Ph.D., **Chemistry**: University of California San Diego, 2001

M.S., **Chemistry**: University of California San Diego, 1998

B.S., **Chemistry**: Harvey Mudd College, 1996

PROFESSIONAL POSITIONS

2010-current: Chair, Department of Chemistry, Sonoma State University

2009-current: Associate Professor of Chemistry, Sonoma State University

2009-current: Adjunct Professor of Biology, Sonoma State University

2003-2009: Assistant Professor of Chemistry, Sonoma State University

2001-2003: UC Regents Post-Doctoral Faculty Fellow,

University of California San Diego

1997-1998: Master Teaching Assistant, University of California San Diego

1996-2001: Graduate Student Researcher, University of California San Diego

AWARDS/RECOGNITIONS

2012: Certificate of Appreciation awarded by the Sonoma State University

Office of Residential Life

2009: Sonoma State University Principal Investigator Recognition

2008: Subject of "Professor Tonks and Her Apprentice" by Yiren Lu in *The Community Voice* Newspaper (Rohnert Park, Cotati, and Penngrove).

2007: University of California San Diego Mentor Recognition Award

2006: Sonoma State University Principal Investigator Recognition

2005: Sonoma State University Order of Omega Award for dedication to and mentoring of students

2001-2003: University of California Faculty Fellow

1997-2001: La Jolla Interfaces in Science Fellow, University of California, San Diego.

1997-1998: National Institute of Health Molecular Biophysics Trainee, University of California, San Diego.

1996: Inducted into Sigma Xi

1996: Harvey Mudd College Graduation with Distinction and Graduation with Honors in Chemistry

PROFESSIONAL AFFILIATIONS

2003-current: California State University Program for Education and Research in Biotechnology

2003-2008: American Chemical Society

TEACHING EXPERIENCE

2012/2013: **School of Science and Technology, Sonoma State University.**

Co-developed and co-taught a summer 2-week intensive Introduction to Research Academy for Santa Rosa Junior College MESA students.

2003-current: **Department of Chemistry, Sonoma State University**

Teaching courses and labs across the lower and upper division chemistry and general education curriculum including: Introduction to Chemistry, 1st and 2nd Semester General Chemistry (with lab), Essentials of General, Organic, and Biochemistry (with lab), Structural Biochemistry, Metabolic Biochemistry, Biochemical Methods Laboratory, Introduction to Chemistry Research, Undergraduate Research, Molecular Mechanisms of Bacterial Pathogenesis, and Chemistry Seminar.

2001-2003: **Department of Chemistry, University of California San Diego**

Taught lower and upper division chemistry and general education coursework including Basic Chemistry, General Chemistry I, GE Chemistry Molecules and Reactions, and Recombinant DNA Laboratory.

1997-1998: **Department of Chemistry, University of California San Diego**

As Master T.A., trained and observed new teaching assistants and consulted with existing teaching assistants having difficulty in the classroom.

RESEARCH EXPERIENCE AND PROJECTS

2003-current: **Department of Chemistry, Sonoma State University**

Project: Investigation of key molecular features in the anti-*Listerial* activity of membrane-active bacteriocins.

2001-2003: **Post-doctoral Research**

Project: Implementation of directed evolution techniques for the expression and characterization of soluble and stable proteins involved in bacterial pathogenesis and HIV.

1996-2001: **Doctoral Studies**

Dissertation: "Bicelles: A Novel Membrane Mimetic for the Characterization of Membrane Associated Peptides and Proteins."

1994-1996: **Undergraduate Research**

Thesis: "Spectroscopic examination of the partitioning of daunomycin in AOT reverse micelles."

GRANTS AWARDED

- Sonoma State University, through the Green Music Center Board of Trustees and the University Affairs Committee, Academic Integration Project Award. "Utilization of the Green Music Center to Expose the SSU Community to Chemistry Through Two Unique Lecture Events." $10,000 (2013-2014), PI.
- Agilent Foundation "STEMpowering THE FUTURE." $8,430 (2013, cont. from 2012), co-PI. Funds the Agilent summer research academy.
- Sonoma State University Research, Scholarship, and Creative Activity Program Mini-Grant. "Determination of Antibacterial Activity of Four Mutated Protein Antibiotics." $4464 (2013), PI.

- Sonoma State University Research, Scholarship, and Creative Activity Program Summer Fellowship. "Structural Characterization of a Protein by NMR." $5780 (2012), PI.

- National Science Foundation Major Research Instrumentation Grant. "Acquisition of a 400-MHz NMR Spectrometer." $308,454 (2011-2014), PI.

- California State University Program for Education and Research in Biotechnology Faculty Development Award. "Mutagenesis and Modeling Studies of the Antimicrobial Peptide Carnobacteriocin B2." $14,993 (2011-2012), PI.

- Sonoma State University Research, Scholarship, and Creative Activity Program. "A Preparation of Mutant Anti-Bacterial Proteins for Structure:Function Analysis." $4217 (2011), PI.

- Agilent Foundation Award. "STEM Saturday and Research Academies" $18, 400 (2011-2012), Academy Leader.

- California State University Program for Education and Research in Biotechnology Travel Grant. $1000 (2010-2011), PI.

- National Science Foundation Major Research Instrumentation Grant. "Acquisition of an isothermal titration calorimeter and differential scanning calorimeter." $183,488 (2007-2009), CO-PI.

- Sonoma State University Research, Scholarship, and Creative Activity Program. "Characterization of key amino acids in the membrane activity of the anti-*Listerial* bacteriocins piscicocin V1a and V1b." $3743 (2005), PI.

- Research Corporation Cottrell College Science Award. "Characterization of key amino acids in the membrane activity of anti-*Listerial* bacteriocins." $34,895 (2005), PI.

- California State University Program for Education and Research in Biotechnology Faculty Seed Grant for Student Research. "Characterization of key amino acids in the membrane activity of anti-*Listerial* bacteriocins." $10,000 (2005), PI.

- California State University Program for Education and Research in Biotechnology Programmatic Development Grant, Curriculum and Infrastructure Development. "Development of a Biochemistry Concentration." $15,000 (2003), CO-PI.

PENDING GRANTS

- Provost Undergraduate Research Award. “Investigation of Key Molecular Features in the Targeting and Toxicity of anti-*Listerial* Proteins” $1,000. Submitted October 7, 2013.

- National Science Foundation Research at Undergraduate Institutions Proposal. “Characterization of Key Molecular Features in the Membrane Activity of anti-*Listerial* Bacteriocins.” $162,882. Resubmitted October 31, 2013.

PUBLICATIONS (* indicate undergraduate students)

1. *Laird, D., *Mulvihill, M. and **Whiles Lillig, J.** “Membrane-Induced Peptide Structural Changes Monitored by Infrared and Circular Dichroism Spectroscopy.” *Biophys Chem* **145**, 72-8 (2009).

2. **Whiles Lillig, J**. “Changing the Focus of the Standard Term-Paper to Encourage Critical Data Analysis in the Upper-Division Chemistry Classroom” *J. Chem. Education* **85***,* 1392-1394 (2008).

3. *Sandoval, C., Geierstanger, B., Fujimura, S., *Balatbat, C., *Williams, T., *de Unamuno, J., **Whiles-Lillig, J**., Ellerby, L.,Ellerby, H., Jennings, P., and Plesniak, L. “Structural evaluation of a novel pro-apoptotic peptide coupled to CNGRC tumor homing sequence by NMR.” *Chem Biol Drug Des*. **67**, 417-24 (2006).

4. Plesniak, L., *Parducho, J., *Ziebart, A. Geierstanger, B., **Whiles, J**., Melacini, G., and Jennings. P. “Orientation and helical conformation of a tissue-specific hunter-killer peptide in micelles.” *Protein Science* **13**, 1988-1996 (2004).

5. **J. Whiles**, K. Glover, R.R. Vold, and E. Komives. “Methods for studying transmembrane peptides in bicelles: Consequences of hydrophobic mismatch and peptide sequence.” *J. Mag. Res.* **158**, 149-156 (2002).

6. **Whiles**, **J.,** Deems, R., Vold, R.R., and Dennis, E. “Bicelles in structure-function studies of membrane associated proteins.” *Biorg. Chem.* **30**, 431-442 (2002).

7. Glover, K., **Whiles, J.,** Vold, R.R., and Melacini, G. “Position of residues in transmembrane peptides with respect to the lipid bilayer: A combined lipid NOEs and water chemical exchange approach in bicelles.” *J. Biomol. NMR* **22**, 57-64 (2002).

8. Glover, K., **Whiles**, **J.,** Wood, M., Melacini, G., Komives, E., and Vold, R.R. “Conformational dimorphism and transmembrane orientation of prion protein residues 110-136 in bicelles.” *Biochem.* **40**, 13137-13142 (2001).

9. Glover, K., **Whiles**, **J.** Wu, G., Deems, R., Struppe, J., Stark, R., Komives, E., and Vold, R.R. "Solution-state bicelles for the study of membrane-associated biomolecules." *Biophys. J.* **81**, 2163-2171 (2001). (Glover and Whiles contributed equally to this work.)

10. **Whiles, J.,** Brasseur, R., Glover, K., Melacini, G., Komives, E., and Vold, R.R. "The orientation and effects of mastoparan X on phospholipid bicelles." *Biophys. J.* **80**, 280-293 (2001).

11. Struppe, J., **Whiles, J.,** and Vold, R.R. "Acidic phospholipid bicelles: A versatile model membrane system." *Biophys. J.* **78**, 281-289 (2000).

12. Karukstis, K., Thompson, E., **Whiles, J.,** and Rosenfeld, R. "Deciphering the fluorescence signature of daunomycin and doxorubicin." *Biophys. Chem.* **73**, 249-263 (1998).

13. Karukstis, K., Frazier, A., Martula, S., and **Whiles, J.** "Characterization of the microenvironments in AOT reverse micelles using multidimensional spectral analysis." *J. Phys. Chem.* **100**, 11133-11138 (1996).

14. Karukstis, K., Suljak, S., Waller, P., **Whiles, J.,** and Thompson, E. "Fluorescence Analysis of single and mixed micelle systems of SDS and DTAB." *J. Phys. Chem.* **100**, 11123-11132 (1996).

MANUSCRIPTS IN PREPARATION (* indicate undergraduate students)

1. *Fisher, K., *Reddy, D., *Oliver, K., *Goldbeck, K., *Anderson, B *Barnes, C., *Anderson, B., and **Whiles Lillig, J.** "Structure, Binding, and Activity Comparison of Wild-Type and C-termial Domain Piscicocins."

2. *Gonzales, F., *Pomponio, J., and **Whiles Lillig, J.** "Characterization of Mastoparan X Binding to Liposomes by Isothermal Titration Calorimetry."

3. Arnold, P., *Barnes, C., *Anderson, B., *Goldbeck, K., and **Whiles Lillig, J.** "Cloning, Expression, Purification, and Mutational Analysis of Carnobacteriocin B2."

PUBLISHED ABSTRACTS

- Poster entitled "Characteristics of surface adsorption of leucine enkephalin on fused silica." Abstract published in the Book of Abstracts, 233nd National Meeting of the American Chemical Society, Chicago, IL, March 2007.

- Poster entitled “Chemistry day outreach program for elementary school students.”

Abstract published in the Book of Abstracts, 232nd National Meeting of the American Chemical Society, San Fransisco, CA, September 2006.

- Poster entitled “Comparison of Structure:Function Relationships in the Membrane

Activity of Piscicocins V1a and V1b.” Abstract published in the Book of Abstracts, 232nd National Meeting of the American Chemical Society, San Fransisco, CA, September 2006.

- “Reading, Writing, and Chemistry: Incorporating General Education Pedagogy into a Single Semester GOB Course.” Abstract published in the Book of Abstracts, 232nd National Meeting of the American Chemical Society, San Francisco, CA, September 2006.

- “Characterization of key Molecular Features in the Membrane Activity of anti-*Listerial* Bacteriocins. Abstract published in the Book of Abstracts, 229th National Meeting of the American Chemical Society, San Diego, CA, March 2005.

- “Partitioning of daunomycin and doxorubicin in AOT reverse micelles.” Abstract published in the Book of Abstracts, 215th ACS National Meeting, Dallas, March 29-April 2, 1998.

- “Spectroscopic examination of the partitioning of daunomycin in AOT reverse micelles.” Abstract published in the Book of Abstracts, 211th ACS National Meeting, New Orleans, LA, March 24-28, 1996.

INVITED SEMINARS /CONFERENCE PRESENTATIONS

- Invited panelist to serve on a mock NSF-RUI grant proposal review panel at the 25th Annual CSU Biotechnology Symposium (CSUPERB), January 2013.

- “Structure:Function Relationships in the Membrane Activity of anti-*Listerial* Peptides.” Scripps College, October 2012.

- “Structure:Function Relationships in the Membrane Activity of anti-*Listerial* Peptides.” Sacramento State University, September 2012.

- Introductory remarks for the graduate school session, 22nd Annual CSU Biotechnology Symposium (CSUPERB), January 2010.

- "Biophysical Characterization of Structure:Function Relationships in the Membrane Activity of Antimicrobial Peptides." Department of Biology, Sonoma State University, September 2008.

- "Spectroscopic Characterization of Structure:Function Relationships in the Membrane Activity of Antimicrobial Peptides." San Jose State University, April 2008.

- "Teaching methods to engage students in large lecture courses." Sonoma State University Faculty Retreat, January 2007.

- "Structure-Function Relationships in the Membrane Activity of Pathogenic Peptides." University of Laverne, Laverne, CA, April 2006.

- "Characterization of Key Molecular Features in the Membrane Activity of Anti-Listerial Bacteriocins."18th Annual California State University Program for Education and Research in Biotechnology Symposium, San Jose, CA, January 2006.

- "Characterization of Key Molecular Features in the Membrane Activity of anti-*Listerial* Bacteriocins." Department of Chemistry, California State University Chico, October 2005.

- "Incorporating Text Based Digital Content into WebCT." Sonoma State University WebCT Faculty Showcase, November 2004.

- "Structure-Function Relationships in the Membrane Activity of Pathogenic Peptides." Sonoma State University Department of Biology Colloquium, December 2003.

- "Bicelles and Directed Evolution: Systems for Studying Membrane-Associated Proteins." Department of Chemistry, Sonoma State University, February 2003.

- "Bicelles and Directed Evolution: Systems for Studying Membrane-Associated Proteins." Department of Chemistry, Harvey Mudd College, November 2002.

POSTER PRESENTATIONS

- "Structural Characterization of a Protein by NMR." SSU Faculty Research Exposition, Sonoma State University, March 2013.

- "A Preparation of Mutant Anti-Bacterial Proteins for Structure:Function Analysis." SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, March 2012.

- "Characterization of Molecular Features Important in the Antibacterial Activity of Bacteriocins." SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, March 2011.

- "Characterization of the Key Molecular Features involved in the Membrane Activity of Antibiotics Produced by Non-Pathogenic Bacteria." SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, March 2008.

- "Structure-Function Relationships in the Membrane Activity of Pathogenic Peptides." SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, April 2006.

- "Characterization of Key Molecular Features Involved in Killing by anti-*Listerial* Bacteriocins." SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, April 2004.

- "Phospholipid Bicelles for Solution State Studies of Membrane Associated Biomolecules. Do They Really Exist?" presented at the Keystone Symposium: Frontiers in NMR in Molecular Biology VII, Big Sky, Montana, January 2001.

- "The Orientation and Effects of Mastoparan X on Phospholipid Bicelles" presented at the 44th Annual Meeting of the Biophysical Society, New Orleans, Louisiana, February 2000.

- "Bicelles vs. Micelles: Structural Analysis of Membrane Associated Peptides" presented at the 40th Annual Experimental NMR Conference, Orlando, Florida, February 2000.

ADDITIONAL PROFESIONAL AND SCHOLARSHIP ACTIVITIES

2013: **Organizer/Host:** CSU Chemistry Department Chairs' Meeting

2013: **External Reviewer:** CSU Channel Islands Department of Chemistry Program Review.

2013-current: **Elected Member:** California State University Program for Education and Research in Biotechnology Strategic Planning Council of the Faculty Consensus Group

2012: **Panelist**: National Science Foundation Major Research Instrumentation Funding Program

2012/2013: **Chair:** California State University Program for Education and Research in Biotechnology Poster Abstract Selection Committee

2012: **Reviewer**: Research Corporation Cottrell College Science Awards

2012: **Research Mentor:** Sonoma State University Science, Technology, Engineering, and Mathematics Summer High School Internship Program (SHIP)

2011: **Chair**: California State University Program for Education and Research in Biotechnology Pauling Teaching Assistant Award Selection Committee

2011: **Team Member:** SSU team sent to the "Assessing GE under EO 1033" CSU symposium, Berkeley, CA.

2011: **Team Member**: SSU team sent to the 2011 Institute on High-Impact Practices and Student Success to develop a campus-wide freshman year experience program that will serve all freshman. Institute presented by the Association of American Colleges and Universities. University of Vermont (Burlington), June 2011.

2011: **Panelist**: *Overcoming Barriers to Taking the STEM Route in College*, Science Cal Pass program, November 2011.

2011: **Member:** M.S. Biology Thesis Committees

-Pete Arnold (Committee Chair)

-Stephen Tavoni

2011: **Research Mentor:** Sonoma State University Science, Technology, Engineering, and Mathematics Summer High School Internship Program (SHIP)

2011: **Session Moderator:** 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011

2010: **Organizer:** Graduate School Information Session at the 23rd Annual California State University Program for Education and Research in Biotechnology symposium

2010: **Reviewer:** Poster abstracts for the 23rd Annual California State University Program for Education and Research in Biotechnology symposium

2010: **Host:** American Chemical Society National Chemistry Week Chemical Demonstration Show.

2010: **Research Mentor:** Sonoma State University Science, Technology, Engineering, and Mathematics Summer High School Internship Program (SHIP)

2010: **Reviewer:** *The Journal of Chemical Education, BioMicroWorld*.

2010: **Reviewer:** California State University Program for Education and Research in Biotechnology Programmatic and Joint-Venture Grant Proposals

2010: **Speaker:** Graduate School Recruitment Session at the annual California State University Program for Education and Research in Biotechnology symposium

2009: **Member:** California State University Program for Education and Research in Biotechnology Andreoli Faculty Service Award Selection Committee

2009: **Reviewer:** *Dyes and Pigments, Biophysical Chemistry*

2008: **Research Mentor:** Sonoma State University Science, Technology, Engineering, and Mathematics Summer High School Internship Program (SHIP)

2008: **Reviewer:** California State University Program for Education and Research in Biotechnology Faculty-Student Collaborative Research Grants

2007: **Reviewer:** California State University Program for Education and Research in Biotechnology Faculty-Student Collaborative Research Grants

2007: **Member:** 19th Annual Northern California American Chemical Society Undergraduate Research Symposium Organizing Committee

2007: **Reviewer:** *Biochemistry*

2007: **Panelist:** "Nourishing Your Scholarship: Grant Writing and Research at SSU" sponsored by the Sonoma State University Professional Development Subcommittee

2006: **Session Moderator:** 18th Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA

2006: **Reviewer:** *Biochemistry*

2006: **Reviewer:** California State University Program for Education and Research in Biotechnology Faculty-Student Collaborative Research Grants

2006: **Reviewer:** "General, Organic, and Biochemistry" textbook for Thomson Brooks/Cole Publishing

2006: **Consultant:** Developed "clicker quizzes" to accompany *General, Organic, and Biochemistry* by Blei and Odein, 2nd Ed., W.H. Freeman and Company Publishers

2006: **Reviewer:** Research Corporation Cottrell College Science Awards

2005: P**resenter:** 20th Forum for Diversity in Graduate Education, Sacramento State University

2005: **Reviewer:** Tenure dossier for the University of Dallas

2005: **Reviewer:** California State University Program for Education and Research in Biotechnology Faculty-Student Collaborative Research Grants

2005: **Consultant:** Developed on-line quizzes to accompany *General, Organic, and Biochemistry* by Blei and Odein, 2nd Ed., W.H. Freeman and Company Publishers

2005: **Consultant:** Developed curriculum including lesson plans, PowerPoint presentations, inquiry-based activities, and assessment methods to meet Arizona State Physical Science standards and model good teaching pedagogy

2004: **Reviewer:** *Biochemistry*

2004: **Reviewer:** "General, Organic, and Biochemistry" text by Ira Blei and George Odian. W.H. Freeman and Company Publishers

2004: **Reviewer:** California State University Program for Education and Research in Biotechnology Faculty-Student Collaborative Research Grants

2004: **Reviewer:** "Experimental Biochemistry Lab Manual" textbook by Charles Hardin and James Knopp. Oxford University Press

UNDERGRADUATE STUDENT RESEARCHERS TRAINED

UNDERGRADUATE STUDENT AWARDS

2013: McNair Fellowship awarded to Josh Guitierrez.

2013: SSU Instructionally Related Activity Awards for Research shared by students Agya Karki, Kelsey Goldbeck, Nick Pasadis, and Karineh Lalikian ($1600).

2012: California State University Program for Education and Research in Biotechnology Presidents' Commission Scholar Award to Matt Applesmith for a summer research experience in my lab ($8000).

2011: Research student Frankie Gonzalez featured on the cover of the CSUPERB Annual Report.

2011: Undergraduate research student Danelle Reddy selected as an SSU competitor in the CSU Student Research Competition.

2011: Graduate student Pete Arnold awarded the California State University Program for Education and Research in Biotechnology Crellin Pauling Student Teaching Award.

2009: California State University Program for Education and Research in Biotechnology Howell Fellowship ($3000) awarded to Kaitlin Fisher.

2009: McNair Fellowship awarded to Danelle Reddy.

2006: California State University Program for Education and Research in Biotechnology Howell Fellowship ($2500) awarded to Melinda Mulvihill.

2005: California State University Program for Education and Research in Biotechnology Student Travel Award presented to Amy Nadel for attendance at the 229th National Meeting of the American Chemical Society, San Diego, CA, March 2005.

2004: California State University Program for Education and Research in Biotechnology Howell Fellowship ($2500) awarded to Justin Foust.

2004: California State University Program for Education and Research in Biotechnology Howell Fellowship ($2500) awarded to Terry Morgan.

PRESENTATIONS AND PUBLISHED WORKS BY/WITH SONOMA STATE UNIVERSITY UNDERGRADUATE STUDENTS

- Poster entitled Poster entitled "Expression, Purification, and Isolation of Carnobacteriocin B2" presented by Nick Pasadis at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

- Poster entitled Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

- Poster entitled Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

- Talk entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- Talk entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- Poster entitled “Expression, Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- Poster entitled “Characterization of HotLap” presented by Albert Basso at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- Poster entitled “Expression, Purification, and Mutational Analysis of Carnobacteriocin B2” presented by Stella Katisi at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- Poster entitled “Summer Introduction to Research and Protein NMR” presented by Matt Applesmith at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

- Poster entitled “Expression , Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis and Casee Barnes at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

- Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

- Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

- Talk entitled "Expression, Purification, and Mutation of Carnobacteriocin B2" presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

- Talk entitled "Expression, Purification, and Mutation of Carnobacteriocin B2" presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

- Talk entitled "Secondary Structure Predictions of Carnobacteriocin B2" presented by Brittany Anderson at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

- Poster entitled "Expression, Purification, and Mutation of Carnobacteriocin B2" presented by Casee Barnes and Pete Arnold at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

- Poster entitled "Secondary Structure Predictions of Carnobacteriocin B2" presented by Brittany Anderson at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

- Talk entitled "Determining Binding Constant for Pentagastrin with Phospholipid Vesicles" presented by Gal Marcan at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

- Talk entitled "Killing Listeria: the Effectiveness of Two Antibacterial Peptides" presented by Danelle Reddy at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

- Paper entitled "Killing Listeria: The Effectiveness of Two Antibacterial Peptides" by Danelle Reddy, published in the Sonoma State McNair Research Journal (V.1), 2010.

- Talk entitled "Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry." Presented by Frankie Gonzales at the 22nd Annual Northern California Undergraduate Research Symposium. CSU Sacramento, May 2010.

- Talk presented by research student Danelle Reddy at the California State University Student Research Competition, May 2010.

- Poster entitled "Effect of Liposome Charge and Size on Mastoparan X Binding Measured by Isothermal Titration Calorimetry." Presented by Frankie Gonzales at the 22nd Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2010.

- Talk entitled "Troubleshooting the cloning of carnobacteriocin B2 as an intein fusion protein." Presented by Amrit Dosanjh at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary's College, California, May 2009.

- Talk entitled "Fluorescence Spectroscopy Analysis of Piscicocins V1a and V1b." Presented by Kaitlin Fisher at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary's College, California, May 2009.

- Talk entitled "Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry." Presented by Jennifer Pomponio at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary's College, California, May 2009.

- Poster entitled "The Effects of Piscicocins V1a and V1b and their C-terminals on *Listeria ivanovii*." Presented by Danelle Reddy at the SSU McNair Scholars Symposium. Rohnert Park, CA, April 2009.

- Poster entitled "Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b." Presented by Kaitlin Fisher at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

- Poster entitled "Determination of Binding Assocation of Mastoparan X to Liposomes by Isothermal Titration Calorimetry." Presented by Jennifer Pomponio at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

- Poster entitled "Troubleshooting the cloning of carnobacteriocin B2 as an intein fusion protein." Presented by Amrit Dosanjh at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

- Poster entitled "Membrane Activity of Piscicocins V1a and V1b Against *Listeria Innocua* Determined by a Liquid Killing Assay." Presented by Vanessa Fuller at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

- Poster entitled "Flourescence Spectroscopy Analysis of Binding Activity of Piscicocins V1a and V1b." Presented by Kaitlin Fisher at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

- Poster entitled "Cloning and Expression of Carnobacteriocin B2 as an Intein Fusion Protein." Presented by Amrit Dosanjh at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

- Talk entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.”

Presented by Alene Seward at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

- Poster entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Alene Seward and Kaitlin Fisher at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

- Poster entitled “Cloning and Expression of Carnobacteriocin B2 as an Intein

Fusion Protein.” Presented by Kristi Herrmann and Amrit Dosanjh at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

- Poster entitled “Membrane Activity of Piscicocins V1a and V1b Against *Listeria*

Innocua Determined by a Liquid Killing Assay.” Presented by Vanessa Fuller at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

- Poster entitled “Characteristics of surface adsorption of leucine enkephalin on fused silica.” 233rd Presented by Nicole Litzie. Abstract published in the Book of Abstracts, 233nd National Meeting of the American Chemical Society, Chicago, IL, March 2007.

- Talk entitled “Isolation and Purification of Human Salivary Peroxidase.” Presented by F. Duncan MacDonald. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Talk entitled “Purification and Characterization of Pectinesterase from Lemon

Fruit.” Presented by Amanda Burnett. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Talk entitled “Secondary Structure Characterization of Membrane Bound Peptides

Using CD and IR Spectroscopy.” Presented by Daniel Laird. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Talk entitled “The Use of Fluorescence Spectroscopy for the Examination of

Binding and Lysis of Membrane Active Molecules.” Presented by Vanessa Abercrombie. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Talk entitled “Expression and Purification of Carnobacteriocin B2 as an Intein Fusion Protein.” Presented by Kristina Herrmann. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Poster entitled “Expression and Purification of Carnobacteriocin B2 as an Intein Fusion Protein.” Presented by Cuyler Goodwin. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Poster entitled “The Use of Fluorescence Spectroscopy for the Examination of Binding and Lysis of Membrane Active Molecules.” Presented by Alene Seward. 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- Poster entitled “Secondary Structure Characterization of Membrane Bound Peptides Using CD and IR Spectroscopy.” Presented by Daniel Laird at the 19th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2007.

- Poster entitled “The Use of Fluorescence Spectroscopy for the Examination of Binding and Lysis by Membrane Active Molecules.” Presented by Vanessa Abercrombie and Alene Seward and at the 19th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2007.

- Poster entitled “Expression of MBP as an Intein Fusion Protein by IPTG Induction.” Presented by Elizabeth Anderson at the 19th Annual California State University Program for Education and Research in Biotechnology Symposium Los Angeles, CA, January 2007.

- Poster entitled “Chemistry day outreach program for elementary school students.” Presented by Krista Prescott. Abstract published in the Book of Abstracts, 232nd National Meeting of the American Chemical Society, San Fransisco, CA, September 2006.

- Poster entitled “Comparison of Structure:Function Relationships in the Membrane Activity of Piscicocins V1a and V1b.” Presented by Daniel Laird. Abstract published in the Book of Abstracts, 232nd National Meeting of the American Chemical Society, San Fransisco, CA, September 2006.

- Talk entitled “Synthesis and Characterization of Class IIa Bacteriocins: Analysis by Infrared Spectroscopy.” Presented by Melinda Mulvihill. 18th Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA, May 2006.

- Synopsis presentation by Melinda Mulvihill on her research at the Doris A.
Howell Foundation Health Education Series Luncheon, La Jolla, CA, April 2006.

- Poster entitled "Synthesis and Characterization of Class IIa Bacteriocins"
Presented by Melinda Mulvihill and Jennifer Oschner. 18th Annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2006.

- Poster entitled "Cloning and Expression of Carnobacteriocin B2 from
Carnobacterium piscicola." Presented by Alene Seward and Sharon Winans. 18th Annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2006.

- Poster entitled "Characterization of key molecular features in the membrane activity of anti-*Listerial* bacteriocins" Presented by Amy Nadel. Abstract published in the Book of Abstracts, 229th National Meeting of the American Chemical Society, San Diego, CA, March 2005.

- Poster entitled "Isolation and purification of carnobacteriocin B2 from
Carnobaterium piscicola." Presented by Angelina Cucci. 17th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2005.

- Poster entitled "Expression and purification of Carnobacteriocin B2 from *E. coli*."
Presented by Nicole Alfaro. 17th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2005.

- Poster entitled "Characterization of key amino acids in the membrane activity of
anti-*Listerial* bacteriocins: A Comparison of Piscicocins V1a and V1b." Presented by Terry Morgan and Justin Foust. 16th annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2004.

CONFERENCES AND WORKSHOPS ATTENDED

- 24th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

- 25th Annual California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

- SSU Faculty Development Workshop "Case Studies and Discussion Based Learning" presented by Armand Gilinsky, Business Administration. Spring 2012.

- 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

- 2nd Annual Sonoma County Science and Math Teachers Colloquium and Noyce Scholarship Award Dinner "Improving Science Knowledge Through Research Experiences." November 2011.

- 23rd Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose State University, CA, May 2011.

- 23rd Annual California State University Program for Education and Research in Biotechnology Symposium. Orange County, CA, January 2011.

- Inaugural Sonoma County Science and Math Teachers Colloquium and Noyce Scholarship Award Dinner "Advancing STEM Education through the Common Core Standards." November 2010.

- National Science Foundation ADVANCE workshop, "Supporting Women in STEM: Sharing Best Practices" Pomona, CA, September 2010.

- 22nd Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara University, CA, May 2010.

- 22nd Annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2010.

- 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary's College, CA, May 2, 2009.

- Sonoma State University Faculty Retreat on Diversity. January 2009.

- 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

- POGIL (Process Oriented Guided Inquiry Learning) techniques in the college classroom. September 2008.

- 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

- "Women's Ways of Leading," sponsored by the American Council on Education through the Office of Women in Higher Education. March 2008.

- 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

- 19th Annual Northern California American Chemical Society Undergraduate Research Symposium. Rohnert Park, CA, May 2007.

- 19th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2007.

- 232nd National Meeting of the American Chemical Society. San Francisco, CA, September 2006.

- 18th Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA, May 2006.

- 18th Annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2006.

- 17th Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2005.

- 16th Annual California State University Program for Education and Research in Biotechnology Symposium. San Jose, CA, January 2004.

- *Teaching General Chemistry Conference*. Sponsored by the California State University Office of the Chancellor and the Center for the Enhancement of Teaching and Learning. California State University Fresno, March 2004.

UNIVERSITY SERVICE

2012-current: **Member:** Elected to the Strategic Planning Council of CSUPERB

2012: **Member:** Department of Chemistry Search Committee

2011-current: **Member, Internal Advisory Board:** SST S3: STEPping up STEM at SSU NSF-funded First Year Experience program.

2011: **Member:** Sonoma State University Team for GE Assessment Conference Berkeley, CA.

2011: **Member:** Sonoma State University Team at the AAC&U Institute for High Impact Practices, Burlingame, VT

2011: **Advisor:** School of Science and Technology Summer Orientation

2011: **Member:** CSU International Programs Applicant Evaluation Committee

2010: **Member:** Student Advising Committee

2010: **Member:** ACE Redesign Committee to restructure the office for advising, career placement and EOP.

2009: **Fall Interim Chair:** Sonoma State University Health Professions Advisory Committee

2009-2011: **Chair:** Science, Technology, Engineering, and Mathematics Internship Selection Committee

2009-2011: **Program Coordinator and Research Mentor:** Science, Technology, Engineering, and Mathematics Summer High School Internship Program

2009: **Judge:** SSU Alpha Gamma Delta Sorority Lip Jam

2008-2010: **Coordinator:** Department of Chemistry General Chemistry Placement Exam

2008: **Member:** Department of Chemistry Search Committee

2008: **Coordinator:** Chemistry Department Space Task Force

2008: **Table Host:** 30th Annual SSU Scholarship Awards Ceremony

2008: **Judge:** SSU Alpha Gamma Delta Sorority Lip Jam

2008-2011: **Member:** Parent Club of the SSU Children's School

2007-current: **Member:** Faculty Consensus Group of the California State University Program for Education and Research in Biotechnology

2007: M**ember:** Department of Chemistry Search Committees.

2007: **Coordinator:** Department of Chemistry Seminar Series

2007: **Member:** Department of Chemistry Search Committees

2007-current: **Member:** Pre-Health Professions Advisory Committee

2007-2009: **Lead Advisor:** Department of Chemistry

2007-2013: **Chair:** Sonoma State University Sub-Committee on Academic Advising

2007: **Advisor:** SSU Chess Club

2006: M**ember:** Department of Chemistry Search Committee.

2006: **Coordinator:** Department of Chemistry Seminar Series

2005: **Member:** Department of Chemistry Search Committees

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2005: **Member:** SSU Team at the summit for system-wide strategic planning to support implementation of LMS. San Franscisco, CA.

2004-2005: **Co-Developer:** Department of Chemistry B.S. Biochemistry Degree

2005-current: **Member:** SSU Sub-Committee on Academic Advising

2004-2006: **Member:** School of Science Darwin Transition and Group II Expenditures Committees

2005: **Spring Proxy Member:** SSU Faculty Standards and Affairs Committee

2005: **Member:** School of Science and Technology Strategic Planning Committee

2004: **Member:** Department of Chemistry Search Committee

2003-2009: **Member:** School of Science and Technology Travel Committee

2003-2006: **Advisor:** Chemistry Club

2003-current: **Advisor:** Chemistry Majors

2003-2006: **Co-coordinator:** Chemistry Department scholarship allocations

.

2000: **Co-Chair:** 1st Annual UCSD All-Grad Symposium

COMMUNITY SERVICE

2013: **Workshop Leader:** Sonoma County Science Fair; Workshop in DNA isolation

2012: **Guest Speaker**: Research and Career Paths for Upward Bound Saturday Academy, Sonoma State University

2011: **Guest Speaker**: Research and Career Paths for Upward Bound Saturday Academy, Sonoma State University

2010-current: **Alumni Prospective Student Interviewer:** Harvey Mudd College

2010-2011: **Volunteer:** McNear Elementary School Kindergarten Classroom, Petaluma, CA

2008: **Chemistry Demonstrator:** Family Fun Night at the Sonoma State University Children's School

2007: **Volunteer Chemistry Tutor**

2005-2011: **Annual Workshop Leader:** Sonoma County Expanding Your Horizons Conference

2004: **Volunteer:** Sonoma Country Expanding Your Horizons Conference

2004: **Co-host:** Girl Scout Troop #156 Laboratory Day: "Chemistry of Foods and Cleaners- Is it an acid or is it a base?"

2003 - current: **Member:** Sonoma State University Experts Guide

2003-2005: **Reviewer:** Project Censored

2002: G**uest Speaker:** Early Academic Outreach Program, University of California San Diego

2000: **Event Captain:** San Diego County Science Olympiad

2000: **Judge:** Greater San Diego Science and Engineering Fair

MENG-CHIH SU

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Rohnert Park, California 94928 **E-mail: sum@sonoma.edu**

U.S.A. **Web: http://www.sonoma.edu/chemistry/su/**

A. Educational Background

- B.S., Chemistry, Soochow University, Taipei, Taiwan (1976)
- M.S., Chemistry, Emporia State University, Emporia, Kansas (1981)
- Ph.D., Chemistry, University of Arkansas, Fayetteville, Arkansas (1986)
- Postdoctoral fellow, Chemistry, Indiana University, Bloomington, Indiana (1986-88)

B. Professional History

- Army (Taiwan): mandatory military service (1976-78)
- China Man-Made Fiber Co. (Taiwan): Assistant chemical engineer (1978-80)
- Indiana University Department of Chemistry: Visiting lecturer (1988)
- Butler University Department of Chemistry: Visiting assistant professor (1988-89), Assistant professor (1989-94), Associate professor (1994-2000), Professor (2000-06)
- Argonne National Laboratory Chemistry Division: Visiting faculty scientist (1993-2004)
- Argonne National Laboratory Chemical Science and Engineering Division: Special term appointee (2005-10), Faculty special term appointee (2011-present)
- Institute of Atomic and Molecular Sciences, Academia Sinica (Taiwan): Visiting professor (2002-04, 2012)
- Sonoma State University Department of Chemistry: Associate professor (2006-08), Professor (2008-present), Department Chair (2007-09)
- Sonoma State University Department of Engineering Science: Department Chair (2012-present)

C. Honorary Awards

- "*The Last Lecture*" Award, Liberal Arts and Sciences College, Butler University (2005)
- LIRP Teaching Award, Butler University (2001)
- Butler University Fellow, Butler University (1990-94)
- University Dissertation Fellow, University of Arkansas (1985-86)

D. Teaching Experience

Sonoma State University:	Chemistry and Society (CHEM102), Introductory General Chemistry (CHEM110), General Chemistry (CHEM115A, 115B), Quantitative Chemical Analysis (CHEM255), Physical Chemistry (CHEM310A, 310B), Physical Chemistry Lab (CHEM316), Instrumental Analysis and Chemical Synthesis: Senior Capstone (CHEM401), Research Seminar (CHEM 497) Digital Circuit & Logic Design (ES112)
Butler University:	General Chemistry (CH105, 106), Organic Chemistry II (CH352), Analytical Chemistry (CH321), Instrumental Analysis (CH422), Physical Chemistry (CH471, 472), Chemistry Seminar (CH492), Interdisciplinary Study: *Change and Transition* (ID201), Honors Colloquium: *Tao and Chemistry* (HN300)
Indiana University:	Physical Chemistry (C360)

E. Research Experience

Protein folding:	Attenuated total reflection spectroscopy study of protein adsorption and conformational changes on fused silica surface
Combustion reactions:	Laser photolysis shock tube high temperature chemical kinetics study by multiple optical pass atomic resonance absorption spectroscopy
Collisional dynamics:	Laser-assisted electron collisional dynamics of discharged neon gas plasma
Molecular energy transfer:	Laser-induced fluorescence spectroscopy of state-to-state vibrational energy transfer in weakly bonded complexes
Lab skills:	Instrument design and construction, high vacuum systems, gas material operations, optics, lasers, electronics, computer interfacing with instruments

F. Publications (Total of 53 papers, only those in the past 5 years listed here.)

1. N. K. Srinivasan, M.-C. Su, and J. V. Michael, "High-Temperature Rate Constants for CH_3OH + Kr → Products, OH + CH_3OH → Products, OH + $(CH_3)_2CO$ → CH_2COCH_3 + H_2O, and OH + CH_3 → CH_2 + H_2O", *J. Phys. Chem. A* 111 (2007) 3951.

2. N. K. Srinivasan, M.-C. Su, J. V. Michael, S.J. Klipperstein and L.B. Harding, "Reflected Shock Tube and Theoretical Studies of High-Temperature Rate Constants for OH + CF_3H → CF_3 + H_2O and CF_3 + OH → Products", *J. Phys. Chem. A* 111 (2007) 6822.

3. N.K. Srinivasan, M.-C. Su, and J.V. Michael, "Reflected Shock Tube Studies of High-Temperature Rate Constants for OH + C_2H_2 and OH + C_2H_4", *Phys. Chem. Chem. Phys.* 9 (2007) 4155.

4. C.M. Kraning, T.L. Benz, K.S. Bloome, G.C. Campanello, V.S. Fahrenbach, S.A. Mistry, C.A. Hedge, K.D. Clevenger, K.M. Gligorich, T.A. Hopkins, G.C. Hoops, H.-C. Chang and M.-C. Su, "Determination of Surface Coverage and Orientation of Reduced Cytochrome c on a Silica Surface with Polarized ATR Spectroscopy", *J. Phys. Chem. C* 111 (2007) 13062.

5. N. K. Srinivasan, M.-C. Su, J. V. Michael, "CH_3 + O_2 → H_2CO + HO Revisited" *J. Phys. Chem. A* 111 (2007) 11589.

6. N. K. Srinivasan, M.-C. Su, J. V. Michael, A.W. Jasper, S.J. Klipperstein and L.B. Harding, "The Thermal Decomposition of CF_3 and The Reaction of CF_2 + OH → CF_2O + H", *J. Phys. Chem. A* 112 (2008) 31.

7. R. Sivaramakrishnan, N. K. Srinivasan, M.-C. Su and J. V. Michael, "High Temperature Rate Constants for OH + Alkanes", *Proc. Combust. Inst.* 32 (2009) 107.

8. S.J. Klippenstein, L.B. Harding, B. Ruscic, R. Sivaramakrishnan, N. K. Srinivasan, M.-C. Su and J.V. Michael, "The Thermal Decomposition of NH_2OH and Subsequent Reactions: Ab Initio Transition State Theory and Reflected Shock Tube Experiments", *J. Phys. Chem. A* 113 (2009) 10241.

9. R. Sivaramakrishnan, M.-C. Su, J.V. Michael, S.J. Klippenstein, L.B. Harding, and B. Ruscic, "Rate Constants for the Thermal Decomposition of Ethanol and Its Bimolecular Reactions with OH and D: Reflected Shock Tube and Theoretical Studies", *J. Phys. Chem. A* 114 (2010) 9425.

10. R. Sivaramakrishnan, M.-C. Su, J.V. Michael, S.J. Klippenstein, L.B. Harding, and B. Ruscic, "Shock Tube and Theoretical Studies on the Thermal Decomposition of Propane for a Roaming Radical Channel", *J. Phys. Chem. A* 115 (2011) 3366.

11. Sebastian L. Peukert, Raghu Sivaramakrishnan, Meng-Chih Su and Joe V. Michael, "Experiment and theory on methylformate and methylacetate kinetics at high temperatures: Rate constants for H-atom abstraction and thermal decomposition", Combustion and Flame, 159 (2012) 2312.

12. S. Peukert, R. Sivaramakrishnan, M-C Su and Joe V. Michael, "High Temperature Rate Constants for H/D + Methyl Formate and Methyl Acetate", Proc. Combust. Inst., (2012) in press.

13. Christopher M.T. Campbell1, Matthew T. Fontana1, Benjamin C. Taggart1, Meng-Chih Su, Chung-Lun Lin, Huan-Cheng Chang, Hui-Jung Chen, "Acid Denaturation and Refolding of Cytochrome c on Silica Surface", *J. Chin. Chem. Soc.* (2013) in press.

G. *Conference Presentations* (118 presentations in total, full list available upon request.)

H. *Selected Invited Lectures*

1. "*Shock Tube Study of H+NO_2 High Temperature Kinetics*" at Institute of Atomic and Molecular Sciences, Academia Sinica, Taiwan, March 28, 2002.
2. "*Introduction to Molecular Vibrational Spectroscopy*" at National Taiwan Normal University, March 21, 2002.
3. " *Shock Tube Study of High Temperature Kinetics*" at National Dong Hwa University, Taiwan, April 8, 2002.
4. " *Shock Tube Study of High Temperature Kinetics*" at Chinese Cultural University, Taiwan, April 25, 2002.
5. "*Tao and Chemistry* " at LAS College Colloquium, Butler University, December 3, 2002.
6. "*The Last Lecture*" at LAS College, Butler University, April 29, 2005.
7. "*Protein Adsorption and Unfolding on Surface*" at Sonoma State University, December 9, 2005.
8. "*The Nano Role of Surface Bound Proteins*" at Sonoma State University, March 1, 2007.
9. "*The Surface Effect in Protein Folding/Unfolding*" at Sonoma State University, February 15, 2010.
10. "*Protein Folding/Unfolding on The Surface*" at Sonoma State University, September 26, 2011.
11. "*Protein Folding on Surface*" at Sonoma State University, September 10, 2012.

I. *Student Research* (Mentored 34 students previously at Butler, including 14 student theses, 2 for master's degrees)

Nicole Litzie: "Characteristics of Surface Adsorption of Leucine Enkephalin on Fused Silica" (Fall 2006-Spring 2007)

Nicole Litzie: "Attenuated Total Internal Reflection Spectroscopy Study of Protein Adsorption on Silica Surface" (Interdisciplinary Master Program thesis, Fall 2007-Spring 2012), now at Petaluma Police Department

Jan Elepano: "Study of Protein Adsorption on Silica Surface" (Spring 2008-Fall 2008, Fall 2009)

Julieann Murella:	"Study of Protein Adsorption on Silica Surface" (Spring 2008-Fall 2009)
Andrew Davidson:	"Imaging and Spectroscopy of Cytochrome c on Silica Surface" (Summer 2008-Spring 2009), now at UC-Davis graduate school
Sophia Grubb:	"Alcohol Denaturation of Cytochrome c" (SSU High School Internship Program, Summer 2009), now at UC-Davis undergraduate study
Matthew Fontana:	"Surface Adsorption Effect on the Alcohol Denaturation of Cytochrome c" (Summer 2009-Spring 2012), now at UCLA graduate school
Christopher Campbell:	"Development of an UV Multiple Optical Passes for the Study of Cytochrome c Surface Adsorption on Fused Silica" (Spring 2011-Spring 2012), now at Dell Co.
Benjamin Taggert:	"Theoretical Study of Protein Surface Adsorption Using Waveguide Spectroscopy" (Fall 2011-Spring 2012), now at UCLA graduate school

J. *Grants* **(in the past 5 years)**

2007: Department of Energy, Argonne National Labs: $4,200.

2008: Department of Energy, Argonne National Labs: $9,000.

2009: Department of Energy, Argonne National Labs: $12,880.

2010: Department of Energy, Argonne National Labs: $9,000.

2011: Department of Energy, Argonne National Labs: $9,000.

2012: Department of Energy, Argonne National Labs: $9,000.

K. *Professional Development* **(in the past 5 years)**

1. Council of Undergraduate Research National Meeting on Research Grants Application and Awarding, Washington, D.C., March 8-10, 2007.

2. Strategic planning retreat, Sonoma State University Department of Chemistry, January 23-24, 2007.

3. CSU Chemistry Chairs Meeting, San Luis Obispo, May 4-5, 2007.

4. CSU-UC STEM Faculty Summit Meeting, San Francisco, May 10-11, 2007.

5. CSU Chemistry Chairs Meeting, San Jose, May 8-9, 2009.

6. Curriculum retreat, Sonoma State University Department of Chemistry, January 26-28, 2010.

7. Assessment retreat, Sonoma State University Department of Chemistry, January 18-20, 2011.

8. Scholarship development retreat, Sonoma State University Department of Chemistry, August 16, 2012.

9. Strategic planning retreat, Sonoma State University Department of Engineering Science Department, December 13-14, 2012.

L. Service Record

Sonoma State University

- Chemical Hygiene Officer, Sonoma State University (2006-09)
- University Standards Subcommittee of the Academic Senate, Sonoma State University (2006-09)
- Asian Fellowship Foundation, Marin Education Fund, Novato, California (2006-07)
- Council of Undergraduate Research (2006-2008) SSU representative
- Chemistry Faculty Search Committee, Sonoma State University (2006-07) analytical chemistry
- Chair of Chemistry Department, Sonoma State University (2007-09)
- California State University Program for Education and Research in Biotechnology (CSUPERB, 2006-10) SSU representative
- Chemistry Faculty Search Committee, Sonoma State University (2007-08) organic and analytical chemistry
- Chemistry Faculty Search Committee, Sonoma State University (2008-09) analytical chemistry
- President's Diversity Council, Sonoma State University (2008-present)
- Retention Tenure and Promotion Committee, School of Science and Technology, Sonoma State University (2009-present)
- Chair of Engineering Science Department, Sonoma State University (2012-present)

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Steven C. Farmer

Education

Ph.D., Organic Chemistry, University of California, Davis, 9/02.

Master of Science, Chemistry, California State University, Sacramento, 8/96.

Bachelor of Science, Chemistry, University of California, Davis, 6/94.

Teaching Experience

Associate Professor of Chemistry, Sonoma State University, 8/11-Present. Gave lectures on course material, wrote exams, and supervised class enrollment. Wrote and implemented laboratory experiments.

Assistant Professor Of Chemistry, Sonoma state university, 8/06-8/11.

Courses taught at Sonoma state university:

Chemistry 115a: General chemistry. Taught the first semester general chemistry for science majors, 2 discussion sections and 2 laboratory sections. The course enrollment was 70. (3 WTUs for lecture, 1 WTU for each discussion section and 2 WTUs for each laboratory section)

Chemistry 115b: General chemistry. Taught the second semester general chemistry for science majors, 1 discussion section and 1 laboratory section. The course enrollment was 72. (3 WTUs for lecture, 1 WTU for each discussion section and 2 WTUs for each laboratory section)

Chemistry 335a: Organic chemistry. Taught the first semester organic chemistry for science majors, 2 discussion sections and 2 laboratory sections. The course enrollment was 53. (3 WTUs for lecture, 1 WTU for each discussion section and 2 WTUs for each laboratory section)

Chemistry 335b: Organic chemistry. Taught the second semester organic chemistry lecture. The course enrollment was 51. (3 WTUs)

Chemistry 336: Organic chemistry laboratory. Ran the lab and discussion associated with the second semester of organic chemistry. The course enrollment was 18. (1 WTU for the discussion section and 2 WTUs for the lab section)

Chemistry 397: Chemistry Practicum. Ongoing supervision of undergraduate students working for the department as a grader and/or a teaching assistant. (1/3 WTU per student)

Chemistry 401: Instrumental Analysis and Chemical Synthesis. Ran the lab and discussion associated with this class. This course was team taught with another chemistry faculty member. (3 WTU)

Chemistry 402: Advanced synthesis and Instrumental Analysis. Ran the lab associated with this class. This course was team taught with another chemistry faculty member. (2 WTU)

Chemistry 492: Chemistry Seminar Series. Invited and hosted seminar speakers. Gave lectures concerning job opportunities for chemistry majors. The course enrollment was 16. (1 WTU per student)

Chemistry 494: Undergraduate Research. Ongoing supervision of undergraduate research students on original research projects. (1/3 WTU per student)

Chemistry 496: The Synthesis and Pharmacology of Biologically Active Molecules. This was an elective course team taught with Dr. Fukuto. (2 WTU).

Chemistry 497: Research Seminar. Ran a discussion section which prepared students to give a department seminar. The course enrollment was 18. (2 WTUs)

Teaching History at SSU

Term	Course	Enrollment	Units
Fall 2006	Chemistry 335a Lecture	51	3
	Chemistry 335a Lab	18	3
	Chemistry 335a Lab	17	3
	Chemistry 494	1	0.33
	New Faculty Release Time	N/A	3
		Unit Total	**12.33**
Spring 2007	Chemistry 335a Lecture	38	3
	Chemistry 335b Lecture	41	3
	Chemistry 336 Lab	18	3
	Chemistry 497	18	2
	Chemistry 494	1	0.33
		Unit Total	**11.33**
Fall 2007	Chemistry 335b Lecture	36	3
	Chemistry 336 Lab	30	6
	Chemistry 397	7	2.33
	Chemistry 494	3	1.0
			12.33
Spring 2008	Chemistry 335a Lecture	52	3
	Chemistry 335a Lab	19	3
	Chemistry 335a Lab	18	3
	Chemistry 397	5	1.65
	Chemistry 494	4	1.32
		Unit Total	**11.97**
Fall 2008	Chemistry 335b Lecture	40	3
	Chemistry 336 Lab	14	3
	Chemistry 397	6	2
	Chemistry 401	18	3

	Chemistry 494	4	1.33
		Unit Total	**12.33**
Spring 2009	Chemistry 335a Lecture	37	3
	Chemistry 335a Lab	19	3
	Chemistry 335a Lab	18	3
	Chemistry 397	3	0.99
	Chemistry 494	5	1.65
		Unit Total	11.64
Fall 2009	Chemistry 335b Lecture	29	3
	Chemistry 336 Lab	15	3
	Chemistry 397	4	1.33
	Chemistry 401	20	3
	Chemistry 494	6	1.98
	Chemistry 335a	20	2
		Unit Total	**14.31**
Spring 2010	Chemistry 115a Lecture	70	3
	Chemistry 115a Lab	23	3
	Chemistry 115a Lab	24	3
	Chemistry 336	16	3
	Chemistry 397	4	1.33
	Chemistry 494	7	2.33
		Unit Total	**15.66**
Fall 2010	Chemistry 115b Lecture	70	3
	Chemistry 115b Lab	23	3
	Chemistry 401	24	3

	Chemistry 397	2	0.66
	Chemistry 492	21	1
	Chemistry 494	5	1.65
		Unit Total	**12.31**
Spring 2011	Chemistry 115a Lecture	95	3
	Chemistry 115a Lab	24	3
	Chemistry 335b Lecture	44	3
	Chemistry 402	10	2
	Chemistry 397	3	0.99
	Chemistry 494	6	1.98
		Unit Total	**13.97**
Fall 2011	Chemistry 115b Lecture	72	3
	Chemistry 335b	36	3
	Chemistry 336b	17	3
	Chemistry 401	21	3
	Chemistry 397	2	0.66
	Chemistry 494	4	1.32
		Unit Total	**13.98**
Spring 2012	Chemistry 335a	54	3
	Chemistry 336a	19	3
	Chemistry 336b	18	3
	Chemistry 397	3	0.99
	Chemistry 494	1	0.33
	Chemistry 496	29	2
	Chemistry 497	18	1
		Unit Total	**13.32**
Summer 2012	Chemistry 115A	24	

Fall 2012	Chemistry 115a Lecture	120	3
	Chemistry 115a Lab	24	3
	Chemistry 336a	36	6
	Chemistry 397	6	1.98
		Unit Total	**13.98**
Spring 2013	Chemistry 115b Lecture	96	3
	Chemistry 335b	51	3
	Chemistry 336a	17	3
	Chemistry 336b	16	3
	Chemistry 397	5	1.65
	Chemistry 494	4	1.32
		Unit Total	**14.97**

Chemistry Lecturer, UC Davis, 1/03 - 8/03 & 4/05-8/06. Primary instructor for the first year general chemistry sequence (Chemistry 2A, B & C) and one quarter of organic chemistry for health sciences (Chemistry 118B). Gave lectures on course material, wrote exams, and supervised class enrollment.

Visiting Organic Chemistry Faculty, CSU Sacramento, 8/02 - 8/03. Primary instructor for first semester organic chemistry lab (Chem 25) and introduction to organic chemistry lecture (Chem 20). Laboratory instructor for introduction to organic and biological chemistry (CHEM 6B). Gave lectures on course material, wrote exams, and supervised class enrollment. Wrote and implemented laboratory experiments.

Teaching Assistant Training Coordinator, Department of Chemistry, UC Davis, 9/97 - 6/99. Gave entrance seminars to incoming chemistry graduate students discussing the requirements for teaching assistants and how to be a more effective teacher. Gave mid-quarter teaching evaluations to all of the incoming chemistry graduate students. Gave quarterly evaluations to incoming ESL chemistry graduate students and monitored their progress throughout their first year.

Head Teaching Assistant, General and Organic Chemistry, UC Davis 1/97-3/97 and 9/97-12/97. Supervised class enrollment. Created grading keys for laboratory reports. Entered and analyzed class grades.

Teaching Assistant, General and Organic chemistry, UC Davis, 9/96 - 9/97. Supervised labs, proctored exams, graded lab reports and gave weekly discussions on laboratory and course material.

Teaching Assistant, General chemistry, CSU Sacramento, 9/94 - 6/96. Supervised labs, proctored exams, graded lab reports and weekly quizzes.

Research Experience

Assistant Professor Of Chemistry, Sonoma state university, 8/06-Present.

Projects: The development of sulfur extrusion methods for oxidized sulfur compounds. The synthesis of novel hybrid nanoparticles.

SSU Supervised Research Students (Chem 494)

- Seth Berg (Chemistry, 9/06-9/07)
- Jake Abel (Chemistry, 8/07-5/10)
- Leah Knight (Chemistry, 8/07-9/09)
- Danielle Lusebrink (Chemistry, 1/08-5/10)
- Diego Morales (Chemistry, 7/08-7/11)
- Leslie Pryor (Chemistry, 1/09-5/10)
- Jeffrey Verde (Chemistry, 8/09-5/11)
- Katie Teschler (Chemistry, 8/09-5/10)
- Joshua Gardner (Chemistry, 12/09-5/10)
- Rosie Geranio (Chemistry, 8/09-5/12)
- Julian Neagu (Chemistry, 8/10-5/11)
- Zahiry Garcia (Chemistry, 8/10-12/10)
- Anthony Mazzola (Chemistry, 8/11-12/11)
- Suskia Hyde (Chemistry, 8/11-12/11)
- Kelly Janssen (Chemistry, 8/11-5/13)
- Tasha Paddeck (Chemistry, 8/11-5/12)
- Michelle Sanner (Chemistry, 8/11-5/13)
- Grason Jensen (Chemistry, 8/11-12/11)
- Troy Baker (Chemistry, 8/12-Present)
- Nikki Ho (Chemistry, 8/12-Present)
- Andrea Malin (Chemistry, 1/13-Present)

Post-Doctoral Researcher, UC Davis, 8/03-4/05.

Project: Development of three different synthetic pathways to tail-functionalized derivatives of 4,7-diamino-1*H*, 6*H*-pyrido[4,3-*d*]pyrimidine-2,5-dione. These derivatives were able to transmit hexagonal order to any species appended to their tail groups.

Experience: Design and implementation of synthetic pathways. Managing an undergraduate researcher. Setting up a research lab and equipment. Ordering start-up glassware and chemicals.

Advisor: Dr. Mark Mascal, Department of Chemistry, UC Davis.

Visiting Organic Chemistry Faculty, CSU Sacramento, 8/02-8/03.

Project: Personal research developing methodologies for the incorporation of organic crystals into polymeric nanoparticles. Development of sulfur extrusion routes to carbazole and biphenylene derivatives.

Doctoral Research, UC Davis, 1996 - 2001.

Project: Synthesis of photoluminescent and electroluminescent polymer / quantum dot composite nanoparticles using ATRP.

Experience: Grafting of polymer chains from the surface of various silica coated nanoparticles using air sensitive Schlenck techniques. Extensive use of Atom Transfer Radical Polymerization (ATRP), Reversible Addition-Fragmentation Chain-Transfer Polymerization (RAFT), and other controlled/living polymerization techniques. Synthesis of novel conducting monomers and polymerization agents. Synthesis of novel and general polymers in solution. These species were characterized using GPC, FTIR, ^{29}Si solid state NMR, UV/Vis, Fluorescence, TEM, Dynamic light scattering, Electron and X-ray diffraction.

Advisor: Dr. Timothy E. Patten, Department of Chemistry, UC Davis.

Project: Development of a 13-step, regiochemically controlled synthetic pathway to the natural product 5,11-dimethyl-6*H*-pyrido[4,3-*b*]carbazole (ellipticine). Development of a new synthetic method for the conversion of phenothiazine to carbazole.

Experience: Multi-step organic synthesis, synthetic methodology development. Standard synthetic purification and characterization techniques.

Advisor: Dr. R. Bryan Miller, Department of Chemistry, UC Davis (Deceased 1998).

Masters Degree Research, CSU Sacramento, 9/94 - 6/96.

The unique molecules diimidazolo[1,2-*d*:2’1’-*f*][1,2-4]triazine and [tris(1,1’-diamino-2,2’-biimidazole)cobalt(III)]Cl_3 were synthesized and characterized by NMR, FTIR and GCMS. Also these and similar derivatives were modeled using *ab initio* and semi-empirical computational methods.

Advisor: Dr. David M. Forkey, Department of Chemistry, CSU Sacramento.

Undergraduate Research, UC Davis, 6/93 - 6/94.

The molecule 3-H-pyrazolo[3,4-*h*]isoquinoline was prepared using a 9-step synthetic pathway and characterized using ^{1}H, ^{13}C NMR, FTIR & X-ray crystallography.

Advisor: Dr. R. Bryan Miller, Department of Chemistry, UC Davis.

Industrial Experience

Senior Scientist, Seres laboratories Inc., Santa Rosa, CA, 8/01-8/02.

Experience: Contract synthesis of small organic molecules following R & D and certified good manufacturing practices (cGMP) guidelines. Process development and reaction scale-up of customer submitted pathways. Writing of project proposals and weekly progress reports.

Supervisor: Ashwin Krishnan, Production Manager, Seres Labs. Inc.

Publications

1) Miller, R.B.; Stowell, J.G.; Jenks, C.W.; **Farmer, S.C.**; Wujcik, C.E.; Olmstead, M. M. A new ring system: 3-H-pyrazolo[3,4-*h*]isoquinoline. An unexpected product from diazotization of an aminoisoquinoline. *Chem. Commun.* **1996**, 24, 2711-2712.

2) **Farmer, S. C.**; Miller, R. B. Modified methods for the synthesis of carbazole from phenothiazine. *Molecules* **2001**, 6, 668-672.

3) **Farmer, S. C.**; Patten, T. E. Synthesis of luminescent organic / inorganic polymer nanocomposites. *Polym. Mater. Sci. Eng.* **2000**, 83, 435-436.

4) **Farmer, S. C.**; Patten, T. E. Photoluminescent polymer/quantum dot composite nanoparticles. *Chem. Mater*. **2001**, 13, 3920-3926.

5) **Farmer, S. C.**; Patten, T. E. Synthesis of electroluminescent organic / inorganic polymer nanocomposites. *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **2001**, 42, 578-579.

6) Patten, T. E.; **Farmer, S. C.** (Thiocarbonyl-thio)carboxylic acid derivatives as transfer agents in reversible addition-fragmentation chain-transfer

polymerizations. *J. Polym. Sci. Part A: Polym. Chem.* **2002**, 40, 555-563.

7) Miller, R. B.; Stowell, J. G.; Dugar, S.; Moock, T. E.; Jenks, C. W.; **Farmer, S. C.**; Phan, B.; Wujcik, C. E.; Olmstead, M. M. Synthetic studies of the formation of pyrazoloisoquinolines. *Tetrahedron* **2002**, 58, 6061-6067.

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8) **Farmer, S. C.**; Mascal, M. Synthesis of the G-C DNA Base Hybrid with a Functional Tail*. J. Org. Chem.* **2006**, 71, 8146 -8150.

9) **Farmer, S. C.**; Berg, S. H. Ring Contracting Sulfur Extrusion from Oxidized Phenothiazine Ring Systems. *Molecules* **2008**, 13, 1345-1352.

10) Morales, D. P.; Taylor, A. S.; **Farmer, S. C.** Desulfurization of Dibenzothiophene and Oxidized Dibenzothiophene Ring Systems. *Molecules* **2010**, 15, 1265-1269.

11) Farmer, S. C.; Pryor, L; Verde, J. Investigation of Fluorescent Molecules for Naematoloma fasciculare. *Abstracts of Papers, 239th ACS National Meeting 2010*, CHED-940.

12) Farmer, S. C. Organic Chemistry Trivia: A way to interest non-chemistry majors. *J. Chem. Ed.* **2011**, 88, 1648-1650.

13) Farmer, S. C. Using Social Networking Sites to Connect with Chemistry Alumni. *J. Chem. Ed.* **2013**, 90, 673-675.

14) Farmer, S. C. Continued Linear Growth of Organic Chemistry Textbooks *Chem. Educator* **2013**, 18, 273-274.

15) Durmus, A.; Gunbas, G.; Farmer, S. C.; Olmstead, M. M.; Mascal, M; Legese, B.; Cho, J.; Beingessner, R. L.; Yamazaki, T.; Fenniri, H. Synthesis of N-substituted Pyrido[4,3-*d*]pyrimidines for the Large-Scale Production of Self-Assembled Rosettes and Nanotubes *J. Org. Chem.*, **2013**, *78* (22), 11421–11426.

Seminars and Presentations

Farmer, S. C.; Patten, T. E. (2000, March). Synthesis of Luminescent Organic / Inorganic Polymer Nanocomposites. Poster board presented at the

American Chemical Society National Meeting, San Francisco, California.

Farmer, S. C.; Patten, T. E. (2001, April). Synthesis of Electroluminescent Organic / Inorganic Polymer Nanocomposites. Poster board presented at the American Chemical Society National Meeting, San Diego, California.

Farmer, S. C.; Mascal, M. (2004, October). Applications of Hydrogen Bonding to the Control of the Nanoscale Structure of Solids. Poster board presented at the American Chemical Society Regional Meeting, Sacramento, California.

Farmer, S.C. (2010, April). Development of Sulfur Extrusion Route to Carbazole Derivatives. Invited lecture presented at the UC Davis R. Bryan Miller Symposium, Davis, California.

Farmer, S.C. (2010, March). Investigation of fluorescent molecules from *Naematoloma Fasciculare*. Poster board presented at the SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, March 18, 2010.

Hollister Nadeau & Steven Farmer (2010, September). Isolating fluorescent molecules from *Naematoloma Fasciculare*. Poster board presented at the SSU SHIP Research Symposium.

Farmer, S.C. (2011, November). Development of Sulfur Extrusion Route to Carbazole Derivatives. Invited lecture presented at the UC Davis R. Bryan Miller Symposium, Davis, California.

Farmer, S.C. (2012, March). This isolation of fluorescent molecules from natural sources. Invited lecture presented at San Francisco State University, San Francisco, California.

Presentations made by students from my lab

Poster entitled “Synthesis of Pyrazole Containing Aromatic Heterocycles.” Presented by Danielle Lusebrink. SSU Faculty Exposition for Scholarship and Sponsored Research. Sonoma State University, March 18, 2009.

Poster entitled “Synthesis of Pyrazole Containing Aromatic Heterocycles.” Presented by Leah Knight. 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. Moraga, CA, May, 2009.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 22nd Annual CSU Biotechnology Symposium. Santa Clara, CA, January, 2010.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 239th Annual ACS National Meeting. San Francisco, CA, March, 2010.

Poster entitled “Synthesis of Fe_3O_4/polystyrene Core-Shell Nanoparticles Using Atom Transfer Radical Polymerization.” Presented by Jake Abel. 22nd Annual Northern California American Chemical Society Undergraduate Research Symposium. Sacramento, CA, May, 2010.

Poster entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Jeffry Verde. 23rd Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA, May, 2011.

Oral Presentation entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Rose Geranio. 24th Annual Northern California American Chemical Society Undergraduate Research Symposium. Mills College, Oakland, CA, April, 2012.

Professional Affiliations

Member of The American Chemical Society (1999-Present)

Member of AMMRL (Association of Managers in Magnetic Resonance Laboratories) (2009-Present)

Professional Development

Completed CSU Security Awareness Training (November, 2011)

Regularly attend joint departmental research group meeting. 2011-Present.

Attended the 22nd Annual CSU Biotechnology Symposium. Santa Clara, CA, January, 2010.

Attended the 239th Annual ACS National Meeting. San Francisco, CA, March, 2010.

Attended the 22nd Annual Northern California American Chemical Society Undergraduate Research Symposium. Sacramento, CA, May, 2010.

Enrolled in the 3 unit UC Davis Enology Department course “Introduction to Winemaking.” January, 2010.

Attending a Chemistry Department Retreat, January 2010.

Attended the SSU OSRP Principal Investigator training 2009.

Became a member of AMMRL (Association of Managers in Magnetic Resonance Laboratories), which is an association of over 1000 individuals who are responsible for the operation of instrumentation for magnetic resonance spectroscopy, including NMR. 2009

Attended the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. Moraga, CA, May, 2009.

Attended Scifinder Scholar training. Rohnert Park, CA, November 2008.

Attended a one-day introductory workshop on Process Orientated Guided Inquiry Learning (POGIL). Rohnert park, CA September 2008.

Additional Scholarship Activities

Reviewed a chapter from the book “Organic Chemistry” 11th ed. By Solomon.

Peer reviewer for the *journal of Organic Chemistry.* Read submitted papers and determined their suitability for publication.

Peer reviewer for the journal *Industrial & Engineering Chemistry Research*. Read submitted papers and determined their suitability for publication.

Peer reviewer for the journal *Materials Research Bulletin*. Read submitted papers and determined their suitability for publication.

Peer reviewer for the journal *Molecules*. Read submitted papers and determined their suitability for publication.

Peer reviewer for the ACS Petroleum research Fund. Read grants and determined their suitability for funding.

Member of the external advisory board for the UC Davis ChemWiki project. Attended meetings and gave advice about how to make the ChemWIki project more accessible to outside institutions.

Principal Investigator, SSU STEM High School Internship Program (2011). Worked with high school student, Austin Mun, on a project entitled," *Fluorescent Molecules and Redwoods*". This student worked in my lab for a month over the summer. They were trained and performed research in my lab on a project designed to increase their interest in science.

Principal Investigator, SSU STEM High School Internship Program (2010). Worked with high school student, Hollister Nadeau, on a project entitled, "*Isolating Fluorescent Molecules in Naematoloma Fasciculare*". This student worked in my lab for a month over the summer. They were trained and performed research in my lab on a project designed to increase their interest in science.

Principal Investigator, SSU STEM High School Internship Program (2008). Worked with high school student, Alex Taylor, on a project entitled, "*Isolating Fluorescent Molecules in Naematoloma Fasciculare*". This student worked in my lab for a month over the summer. They were trained and performed research in my lab on a project designed to increase their interest in science.

University Service

Lead, Reorganization and Formal Inventory of the Chemistry Department's Chemical Storage Shed. Removed all chemicals from the storage shed and temporarily returned them to the chemistry department. Determined the safety statuses of all chemicals and removed any unlabeled, broken, or out of date containers. Updated the chemistry department's inventory which included entering in over 1000 new chemicals which were not previously on the chemistry department's inventory. Returned the chemicals to the shed in such a way that they can be easily obtained.

Lead, Reorganization of Chemistry Department Stockroom and preparation for the following Semester. (2011) Completely reorganized the stockroom to prepare for a stockroom technician. Generated the currently working inventory of all stockroom material which previously never existed. Removed old and outdated materials from the stockroom. Because the new stockroom technician hire was not expected to start until after beginning of the semester I temporarily took over the role of the stockroom technician to ensure a smooth beginning of the semester. This included, generating locker checkout sheets, assigning student laboratory lockers, making sure the student laboratory lockers were complete and ready for the new semester, gathering chemistry lab manuals for the new semester, determining the expected needs of the stockroom for the upcoming semester, Developing procedures for preparing all chemistry labs for the upcoming semester. Ordering all chemicals and material required by chemistry department labs for the upcoming semester.

Member Associated Students Election Appeals Committee (2013). Listened to appeals made by students regarding the Associated Students Elections. Made determinations if any violations were made.

Member, Enhanced Co-Curricular Opportunities Task Force (2013). Worked with other members to determine how to provide increase efficiency in SSU's Co-Curricular Opportunities.

Member, Department of Chemistry, Retention, Tenure, Promotion Committee (2011-2013). Evaluated RTP files for chemistry department candidates. Also evaluated part-time chemistry faculty.

Committee Member and Chair, Department of Chemistry Search Committee (20012-2013). Chair of the chemistry department's committee to search for a tenure-track biochemistry faculty member. The committee successfully made a hire.

Planner for Academic Freedom Workshop (2011). Helped to plan and participated in a workshop designed to inform members of the SSU campus about Academic Freedom.

McNair Scholar Advisor (2010). Oversaw and advised the McNair Scholar Jacqueline Perez as she performed research on the drug Dex-methasone.

Lead Advisor, Chemistry Department (2010). Kept a record of all chemistry majors and assigned them a chemistry department advisor. Acted an initial contact for incoming and transfer students.

Member, Temporary Faculty Hiring Committee (2010). Read resumes and ranked optional adjunct faculty. Performed interviews in person and over the phone.

Seminar organizer, Department of Chemistry (Fall, 2009).

Invited speakers and organized the seminar series. Acted as host for on-campus visitors.

Principal Investigator, SSU STEM High School Internship Program (2010). Worked with a high school student selected from a local school. This student worked in my lab for a month over the summer. They were trained and performed research in my lab on a project designed to increase their interest in science.

Member, SSU council of campus mentors (2010). Placed my contact information on a campus list so that students could contact me if they need mentoring. Attended organizational meetings.

Advisor, The Pre-Health Professions Club, SSU (2010-Present).

Advised the Pre-Health Club regarding activities.

Participant, RUP observation day, SSU (2010). Was observed by a high school teacher. Was involved in a discussion regarding better preparing high school students for college chemistry.

Committee Member, Academic Freedom committee (2009-Present).

Updated those portions of the Faculty Handbook relevant to academic freedom and developed and recommended a policy on academic freedom to FSAC.

Alumni Outreach Organizer, Department of Chemistry (2009-Present). Charged with maintaining a data base of SSU chemistry alumni. Did searches to make contact with past alumni. Designed and maintained an SSU chemistry alumni Facebook site. Designed methods for tracking alumni career progress.

Advisor, SST Health Professions Advisory Committee (2009- 2010). Aided pre-health students in planning their careers and their applications for medical schools.

Committee Member, SST Health Professions Advisory Committee (2009-Present). Participate in advising, mock interviews, and writing letters of recommendation for students pursuing a health profession.

Chair, Chemistry Department Space Committee (2008-2009). Designed a plan to utilize storage space throughout the chemistry department based off of input from faculty members. Relocated department items previously located in long-term storage after the Darwin Remodel. Wrote an inventory for the relocated items. Designed a plan to relocate chemicals previously located at the storage shed. Coordinated with EH & S to make sure the move followed all relevant safety protocols.

Seminar organizer, Department of Chemistry (Fall, 2009).

Invited speakers and organized the seminar series. Acted as host for on-campus visitors.

Advisor, The Anime Club, SSU (2008-2009).

Advised the chemistry club regarding activities.

Committee Member, Department of Chemistry Search Committee (2009).

Committee for tenure-track analytical chemistry search.

Advisor, SSU SOAR Program (2008).

Advised incoming freshmen SST students regarding registration and enrollment.

Seminar organizer, Department of Chemistry (Fall, 2008).

Invited speakers and organized the seminar series. Acted as host for on-campus visitors. This effort was not compensated with release units.

Advisor, The Invisible Children Club, SSU (2008-Present).

Advised the chemistry club regarding activities.

Committee Member, Faculty Hearing Panel (2008-2009).

This committee was charged with helping to resolve disputes involving faculty.

Committee Member, Radiation Safety Committee (2008-Present).

This committee was charged with determining radiation safety policy for Sonoma State University and reviewing proposals involving radioactive materials.

Seminar organizer, Department of Chemistry (Spring, 2007).

Brought in external speakers to present public chemistry seminars in conjunction with the Chemistry 497 course.

Committee Member, Darwin Space Committee (2006-2007).

This committee was charged with determining the posting and display policy for Darwin hall.

Committee Member, Department of Chemistry Search Committee (2007).

Committee for tenure-track organic chemistry search.

Committee Member, Department of Chemistry Search Committee (2007).

Committee for tenure-track analytical chemistry search.

Committee Member, Department of Chemistry Search Committee (2006).

Committee for tenure-track analytical chemistry search.

Advisor, Chemistry Club, SSU (2006-2010).

Advised the chemistry club regarding activities.

Session Mediator for the 19th Annual Undergraduate Research

Conference (2007). Moderated presentations by undergraduates.

Chair, Chemistry Department Steering Committee (2007). Coordinated efforts to solicit donations to the chemistry department. Planned alumni / retiring faculty functions.

Advisor for SSU chemistry majors (2006-current). Aided chemistry majors in planning their academic schedules and careers.

Grants

Funded

Program Advisor, Instructionally Related Activities Program. Sonoma State University, "Chemistry Seminar Series." $9,000 (2013)

Co-PI, Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics. National Science Foundation. "Collaborative Research: Advancing Undergraduate Chemistry Education with Dynamic Open-Access ChemWiki HyperTextbook." $28,000. Submitted May 2012.

CO-PI, Major Research Instrumentation Acquisition. National Science Foundation. "MRI: The Acquisition of a 400 MHz NMR Spectrometer." $329,513. (2011).

Principal Investigator, Research, Scholarship, and Creative Activity Program. Sonoma State University. "Investigation of fluorescent molecules from Naematoloma Fasciculare." $2,735 (2011).

Program Advisor, Instructionally Related Activities Program. Sonoma State University, "Chemistry Seminar Series." $7,900 (2011)

Program Advisor, Instructionally Related Activities Program. Sonoma State University, "Chemistry Seminar Series." $8,000 (2009)

Principal Investigator, Research, Scholarship, and Creative Activity Program. Sonoma State University. "Synthesis of Pyrazole Containing Aromatic Heterocycles." $2,235 (2007).

Program Advisor, Instructionally Related Activities Program. Sonoma State University, “Chemistry Seminar Series.” $3,500 (2008)

Submitted

None Pending

Submitted but Not Funded

Principal Investigator, Faculty Seed Grant for Student Research, CSUPERB.

“Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” $13,000. (2011)

Co-Pi, UC Davis ChemWIki Project. Grants submitted to the Dept. of Education and Bill and Melinda Gates Foundation. (2010)

Principal Investigator, Major Research Instrumentation Acquisition. National Science Foundation. “MRI: The Acquisition of a High-Field NMR Spectrometer.” $327,098. (2010).

Principal Investigator, Faculty Seed Grant for Student Research, CSUPERB.

“Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” $11,300. (2010)

Principal Investigator, Major Research Instrumentation Acquisition. National Science Foundation. “MRI^2: The Acquisition of a High-Field NMR Spectrometer.” $349,058. Submitted August 2009.

Contributor, Research Experiences for Undergraduates, National Science Foundation. “California Holistic Experience for the Education of Research Scientists or CHEERS.” $202,920. Submitted August 2009.

Principal Investigator, Major Research Instrumentation Acquisition. National Science Foundation. “MRI: The Acquisition of a High Field NMR Spectrometer and a Liquid Chromatography / Mass Spectrometer.” $642,084. Submitted

January 2008.

Community Service

Invited Presenter, Mark West School district Science Fair (2013).

Manned a booth at an all-day science fair. The demo involved making bubbles from CO_2 gas sublimed from dry ice.

Invited Presenter, Synopsys-Sonoma County Science Fair (2013). Gave a discussion to High School and Junior School students about Fluorescents and careers in Chemistry.

Invited Presenter, Mark West School district Science Fair (2011).

Manned a booth at an all-day science fair. The demo involved making bubbles from CO_2 gas sublimed from dry ice.

Co-host with SSU Chemistry club, National chemistry week community outreach day (2010).

Supervised the chemistry club as they hosted roughly 60 3rd grade students from Roseland elementary School. The students were shown a series of demonstrations which were designed to promote science learning.

Invited Presenter, Hahn Elementary Science Fair (2010). Manned a series of demonstrations along with members of the SSU Chemistry Club.

Member CSU Fresca (2010-Present). Developed a web-based database of my research expertise, scholarship, and creative activities at SSU.

Invited Presenter, Mark West School district Science Fair (2009).

Manned a booth at an all-day science fair. The demo involved the students having access to a variety of objects which fluoresce under a black light.

Co-host with SSU Chemistry club, National chemistry week community outreach day (2008).

Supervised the chemistry club as they hosted roughly 60 3rd grade students from Roseland elementary School. The students were shown a series of demonstrations which were designed to promote science learning.

Invited Presenter, Mark West School district Science Fair (2008).

Manned a booth at an all-day science fair. The demo involved the students having access to a variety of objects which fluoresce under a black light.

Co-host with SSU Chemistry club, National chemistry week community outreach day (2007).

Supervised the chemistry club as they hosted roughly 60 3rd grade students from Hahn Elementary School. The students were shown a series of demonstrations which were designed to promote science learning.

Invited Presenter, Rielbi Elementary School Science Fair (2008).

Manned a booth at an all-day science fair. The demo involved the students having access to a variety of objects which fluoresce under a black light.

Co-host with SSU Chemistry club, National chemistry week community outreach day (2006).

Supervised the chemistry club as they hosted roughly 60 3rd grade students from Valley Vista Elementary. The students were shown a series of demonstrations which were designed to promote science learning.

Member, SSU's Expert Guide (2006-present).

Available to answer questions from the community regarding organic chemistry, polymers and nanotechnology.

Honors and Awards

1997 Received the UCD Chemistry Department's Outstanding Teaching Assistant Award

2003 Finalist for CSUS Chemistry Department's T. H. Cheng Outstanding Teaching award.

Included in *Who's Who among America's Teachers* (8th ed., 2004)

2004 Recognized as a Distinguished Educator by the Associated Students of UC Davis

Included in *Who's Who among America's Teachers* (9th ed., 2005)

2011 Received the Sonoma State University Sarlo Excellence in Teaching Award.

2012 Received the Santa Rosa Chamber of Commerce Excellence in Education Award.

Jon M. Fukuto

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Academic Record:

1978	B.A. Chemistry-Biochemistry	UC San Diego
1983	Ph.D. Organic Chemistry	UC Berkeley
1983-86	Post-Doctoral Fellow (Pharmacology)	UC Los Angeles
1989-1995	Assistant Professor of Pharmacology	UC Los Angeles
1995-2000	Associate Professor of Pharmacology	UC Los Angeles
2000-2008	Professor of Pharmacology	UC Los Angeles
2008-2013	Associate Professor of Chemistry	Sonoma State University
2013-present	Professor of Chemistry	Sonoma State University

Peer-Reviewed Publications:

1. Fukuto, J. M. and Jensen, F. R. (1983) The Mechanism of S_E2 Reactions: Emphasis on Organotin Compounds, *Acc. Chem. Res.*, 16, 177-184.

2. Castro, C. E., Wade, R. S. and Fukuto, J. M. (1984) 1-Iminoalkylimidazoles *via* Cuprous Imidazolide, *J. Heterocyclic Chemistry*, 21, 1905-1906.

3. Fukuto, J. M., DiStefano, E. W., Burstyn, J. N., Valentine, J. S. and Cho, A. K. (1985) Mechanism of Oxidation of N-Hydroxyphentermine by Superoxide, *Biochemistry*, 24, 4161-4167.

4. Fukuto, J. M., Brady, J. F., Burstyn, J. N, VanAtta, R., Valentine, J. S. and Cho, A. K. (1986) Direct Formation of Complexes Between Cytochrome P450 and Nitrosoarenes, *Biochemistry*, 25, 2714-2719.

5. Fukuto, J. M., Newman, D. A. and Jensen, F. R. (1987) Stereochemistry and Mechanisms of Reactions of Electrophiles with Organotin Compounds, *Organometallics*, 6, 415-420.

6. Lee, P. W., Stearns, S., Hernandez, H. and Fukuto, J. M. (1990) The Environmental Fate of Monocrotophos, *J. Ag. Food Chem*., 38, 567-573.

7. Fukuto, J. M., Wood, K. S., Byrns, R. E. and Ignarro, L. J. (1990) N^G-Amino-L-Arginine: A New Potent Antagonist of L-Arginine Mediated Endothelium-Dependent Relaxation, *Biochem. Biophys. Res. Comm*., 168, 458-465.

8. Gold, M. E., Wood, K. S., Byrns, R. E., Fukuto, J. M. and Ignarro, L. J. (1990) N^G-Methyl-L-Arginine Causes Endothelium-Dependent Contraction and Inhibition of Cyclic GMP Formation in Artery and Vein, *Proc. Natl. Acad. Sci. USA*, 87, 4430-4434.

9. Ignarro, L. J., Bush, P. A., Buga, G. M., Wood, K. S., Fukuto, J. M. and Rajfer, J. (1990) Nitric Oxide and Cyclic GMP Formation upon Electrical Field Stimulation Cause Relaxation of Corpus Cavernosum Smooth Muscle, *Biochem. Biophys. Res. Comm*., 170(2), 843-850.

10. Burstyn, J. N., Iskandar, M., Brady, J. F., Fukuto, J. M. and Cho, A. K. (1991) Comparative Studies of N-Hydroxylation and N-Demethylation by Microsomal Cytochrome P450, *Chem. Res. Toxicol*., 4, 70-76.

11. Buga, G. M., Gold, M. E., Fukuto, J. M. and Ignarro, L. J. (1991) Shear Stress-Induced Release of Nitric Oxide From Endothelial Cells Grown on Beads, *Hypertension*, 17(2), 187-193.

12. Brady, J. F., Wang, M.-H., Hong, J.-Y., Xiao, F., Li, Y., Yoo, J.-S. H., Ning, S. M., Lee, M.-J., Fukuto, J. M., Gapac, J. M. and Yang, C. S. (1991) Modulation of Rat Hepatic Microsomal Monooxygenase Enzymes and Cytotoxicity by Diallyl Sulfide, *Toxicol. Appl. Pharm*., 108(2), 342-354.

13. Patel, N., Kumagai, Y., Unger, S. E., Fukuto, J. M. and Cho, A. K. (1991) The Transformation of Dopamine and α-Methyldopamine by NG108-15 Cells: Formation of Thiol Adducts, *Chem. Res. Toxicol*., 4(4), 421-426.

14. Fukuto, J. M., Kumagai, Y. and Cho, A. K. (1991) The Determination of the Mechanism of Demethylenation of Methylenedioxyphenyl Compounds by Cytochrome P450 using Deuterium Isotope Effects, *J. Med. Chem*., 34(9), 2871-2876.

15. Wallace, G. C. and Fukuto, J. M. (1991) The Synthesis and Bioactivity of N-Hydroxyarginine: A Proposed Intermediate in the Biosynthesis of Nitric Oxide from Arginine, *J. Med. Chem*., 34(5), 1746-1748.

16. Brady, J. F., Ishizaki, H., Fukuto, J. M., Lin, M. C., Fadel, A., Gapac, J. M. and Yang, C. S. (1991) Inhibition of Cytochrome P450IIE1 by Diallyl Sulfide and its Metabolites, *Chem. Res. Toxicol*., 4, 642-647.

17. Wallace, G. C., Gulati, P. and Fukuto, J. M. (1991) N-Hydroxy-L-Arginine: A Novel Arginine Analog Capable of Causing Vasorelaxation in Bovine Intrapulmonary Artery, *Biochem. Biophys. Res. Comm*., 176(1), 528-534.

18. Ignarro, L. J., Wood, K. S. and Fukuto, J. M. (1991) Continuous Basal Release of Endothelium-Derived Relaxing Factor and Muscle-Derived Relaxing Factor, Both of Which Are Nitric Oxide, *J. Cardiovas. Pharmacol*., 17(S3), S229-S233.

19. Fukuto, J. M., Wallace, G. C., Hszieh, R. and Chaudhuri, G. (1992) The Chemical Oxidation of N-Hydroxyguanidine Compounds: Release of Nitric Oxide, Nitroxyl and the Relevance to the Mechanism of Nitric Oxide Biosynthesis, *Biochem. Pharmacol.*, 43(3), 607-613.

20. Fukuto, J. M., Hszieh, R., Gulati, P., Chiang, K. T. and Nagasawa, H. T.: N,O-Diacylated-N-Hydroxyarylsulfonamides (1992) Nitroxyl Precursors with Potent Smooth Muscle Relaxant Properties, *Biochem. Biophys. Res. Commun*., 187(3), 1367-1373.

21. Fukuto, J. M., Chiang, K., Hszieh, R., Wong, P. and Chaudhuri, G. (1992) The Pharmacological Properties of Nitroxyl (HNO): A Potent Vasodilator with Activity Similar to Nitric Oxide (NO) and/or Endothelium-Derived Relaxing Factor (EDRF), *J. Pharmacol. Exp. Ther*., 263(2), 546-551.

22. Hayashi, T., Fukuto, J. M., Ignarro, L. J. and Chaudhuri, G. (1992) Basal Release of Nitric Oxide (NO) from Aortic Rings is Greater in Female Rabbits than in Male Rabbits: Implications for Atherosclerosis, *Proc. Natl. Acad. Sci., USA*, 89, 11259-11263.

23. Fukuto, J. M., Stuehr, D. J., Feldman, P. L., Bova, M. P. and Wong, P. (1993) Peracid Oxidation of N-Hydroxyguanidine Compounds: A Chemical Model for the Oxidation of N-Hydroxy-L-Arginine by Nitric Oxide Synthase, *J. Med. Chem*., 36(18), 2666-2670.

24. Ignarro, L. J., Fukuto, J. M., Griscavage, J. M., Rogers, N. E. and Byrns, R. E. (1993) Oxidation of Nitric Oxide in Aqueous Solution to Nitrite but not Nitrate: Comparison of Enzymatically Formed Nitric Oxide from L-Arginine, *Proc. Natl. Acad. Sci., USA*, 90(17), 8103-8107.

25. Komori, Y., Chiang, K. T. and Fukuto, J. M. (1993) The Effect of Non-Ionic Detergents on the Activity and/or Stability of Rat Brain Nitric Oxide Synthase, *Arch. Biochem. Biophys.*, 307(2), 311-315.

26. Fukuto, J. M., Hobbs, A. J. and Ignarro, L. J. (1993) Conversion of Nitroxyl (HNO) to Nitric Oxide in Biological Systems: The Role of Physiological Oxidants and Relevance to the Biological Activity of HNO, *Biochem. Biophys. Res. Commun*., 196(2), 707-713.

27. Fukuto, J. M., Gulati, P. and Nagasawa, H. T. (1994) Involvement of Nitroxyl (HNO) in the Cyanamide-Induced Vasorelaxation of Rabbit Aorta, *Biochem. Pharmacol*., 47(5), 922-924.

28. Daghigh, F., Fukuto, J. M. and Ash, D. E.: Development of Inhibitors of Rat Liver Arginase (1994) Potent Inhibition of the Enzyme by N-Hydroxy-L-Arginine, an Intermediate in Nitric Oxide Biosynthesis, *Biochem. Biophys. Res. Commun*., 202(1), 174-180.

29. Griscavage, J. M., Fukuto, J. M., Komori, Y. and Ignarro, L. J. (1994) Nitric oxide inhibits neuronal nitric oxide synthase by interacting with the heme prosthetic group: Role of tetrahydrobiopterin in modulating the inhibitory action of nitric oxide, *J. Biol. Chem*., 269(34), 21644-21649.

30. Hobbs, A. J., Fukuto, J. M. and Ignarro, L. J. (1994) Formation of Free Nitric Oxide from L-Arginine by Nitric Oxide Synthase and Enhancement of Generation by Superoxide Dismutase, *Proc. Natl. Acad. Sci., USA*, 91(23), 10992-10996.

31. Komori, Y., Wallace, G. C. and Fukuto, J. M. (1994) The Inhibition of Purified Nitric Oxide Synthase from Rat Cerebellum and Macrophage by L-Arginine Analogs, *Arch. Biochem. Biophys*., 315(2), 213-218.

32. Kumagai, Y., Fukuto, J. M. and Cho, A. K. (1994) The Biochemical Disposition of Methylenedioxyphenyl Compounds, *Curr. Med. Chem*., 4, 254-261.

33. Hyun, J., Komori, Y., Chaudhuri, G., Ignarro, L. J. and Fukuto, J. M. (1995) The Protective Effect of Tetrahydrobiopterin on the Nitric Oxide-Mediated Inhibition of Purified Nitric Oxide Synthase, *Biochem. Biophys. Res. Commun*., 206(1), 380-386.

34. Komori, Y., Chiang, K. T. and Fukuto, J. M. (1995) The Role of Thiols in the Apparent Activation of Rat Brain Nitric Oxide Synthase (NOS), *J. Biochem*., 117, 923-927.

35. Nagasawa, H. T., Kawle, S. P., Elberling, J. A., DeMaster, E. G. and Fukuto, J. M. (1995) Prodrugs of Nitroxyl as Potential Aldehyde Dehydrogenase Inhibitors *vis a vis* Vascular Smooth Muscle Relaxants, *J. Med. Chem*., 38, 1865-1871.

36. Abu-Soud, H. M., Wang, J., Rousseau, D. L., Fukuto, J. M., Ignarro, L. J. and Stuehr, D. J. (1995) Neuronal NO Synthase Self-Inactivates by Forming a Ferrous-Nitrosyl Complex During Aerobic Catalysis, *J. Biol. Chem*., 270(39), 22997-23006.

37. Yoo, J. and Fukuto, J. M. (1995) Oxidation of N-Hydroxyguanidine by Nitric Oxide and the Possible Generation of Vasoactive Species, *Biochem. Pharmacol*., 50(12), 1995-2000, 1995.

38. Hayashi, T., Fukuto, J. M., Ignarro, L. J. and Chaudhuri, G. (1995) Gender Differences in Atherosclerosis: Possible Role of Nitric Oxide, *J. Cardiovasc. Pharmacol.*, 26(5), 792-802.

39. Farias-Eisner, R., Chaudhuri, G., Aeberhardt, E. and Fukuto, J. M. (1996) The Chemistry and Tumoricidal Activity of Nitric Oxide-Hydrogen Peroxide and the Implications to Cell Resistance/Susceptibility, *J. Biol. Chem*., 271(11), 6144-6151.

40. Sherman, M. P., Wong, V. Z., Aeberhardt, E. E., Fukuto, J. M. and Ignarro, L. J. (1996) Amplified Nitric Oxide Production by Pulmonary Alveolar Macrophages of Newborn Rats, *Redox Report*, 2(5), 309-316.

41. Fukuto, J. M and Ignarro, L. J. (1997) *In Vivo* Aspects of Nitric Oxide (NO) Chemistry: Does Peroxynitrite ($^{-}$OONO) Play a Major Role in Cytotoxicity?, *Acc. Chem. Res.*, 30 (4), 149-152.

42. Wink, D. A., Feelisch, M., Fukuto, J., Christodoulou, D., Jourd'heuil, D., Grisham, M., Vodovotz, V., Cook, J. A., Krishna, M., DeGraff, W., Kim, S., Gamson, J. and Mitchell. J. B. (1998) The Cytotoxicity of Nitroxyl: Possible Implications for the Pathophysiological Role of NO, *Arch. Biochem. Biophys.*, 351(1), 66-74.

43. Wong, P. S.-Y., Hyun, J., Fukuto, J. M., Shiroda, F. N., DeMaster, E. G. and Nagasawa, H. T. (1998) The Reaction between Nitrosothiols and Thiols: Generation of Nitroxyl (HNO) and Subsequent Chemistry, *Biochemistry*, 37(16), 5362-5371.

44. Buga, G. M., Wei, L. H., Bauer, P. M., Fukuto, J. M. and Ignarro, L. J. (1998) N^G-Hydroxy -L-Arginine and Nitric Oxide Inhibit Caco-2 Tumor Cell Proliferation by Distinct Mechanisms, *Am. J. Physiol.*, 275, R1256-R1264.

45. Lan, E. H., Bakal, C. D., Fukuto, J. M., Dunn, B., Zink, J. and Valentine, J. S. (1999) Synthesis of Sol-Gel Encapsulated Heme Proteins with Chemical Sensing Properties, *J. Materials Chem.*, 9, 45-53.

46. Wong, P. S.-Y. and Fukuto, J. M. (1999) Reaction of Organic Nitrate Esters and S-Nitrosothiols with Reduced Flavins: A Possible Mechanism of Bioactivation, *Drug Metab. Disp.*, 27(4), 502-509.

47. Hyun, J., Chaudhuri, G. and Fukuto, J. M. (1999) The Reductive Metabolism of Nitric Oxide in Hepatocytes: Possible Interaction with Thiols, *Drug Metab. Disp.*, 27(9), 1005-1009.

48. Bauer, P. M., Fukuto, J. M., Buga, G. M., Pegg, A. E. and Ignarro, L. J. (1999) Nitric Oxide Inhibits Ornithine Decarboxylase by S-Nitrosylation, *Biochem. Biophys. Res. Commun.*, 262, 355-358.

49. Ma, X. L., Cao, F., Liu, G. L., Lopez, B. L., Christopher, T. A., Fukuto, J. M., Wink, D. A. and Feelisch, M. (1999) Opposite effects of nitric oxide and nitroxyl on postischemic myocardial injury, *Proc. Natl. Acad. Sci., USA*, 96(25), 14617-14622.

50. Tantillo, D., Fukuto, J. M., Silverman, R. B. and Houk, K. N. (2000) Theoretical Studies on N^G-Hydroxy-L-Arginine and Derived Radicals: Implications for the Mechanism of Nitric Oxide Synthase, *J. Am. Chem. Soc.*, 122(3), 536-537.

51. Shinyashiki, M., Chiang, K. T., Switzer, C. H., Gralla, E. B., Valentine, J. S., Thiele, D. J. and Fukuto, J. M. (2000) The Interaction of Nitric Oxide (NO) with the Yeast Transcription Factor Ace1: A Model System for NO-Protein Thiol Interactions with Implications to Metal Metabolism, *Proc. Natl. Acad. Sci., USA*, 97(6), 2491-2496.

52. Chiang, K. T., Shinyashiki, M., Switzer, C. H., Valentine, J. S., Gralla, E. B., Thiele, D. J. and Fukuto, J. M. (2000) The Effects of Nitric Oxide (NO) on the Copper-Responsive Transcription Factor Ace1 in *Saccharomyces cerevisiae*: Cytotoxic and Cytoprotective Actions of NO, *Arch. Biochem. Biophys.*, 377(2), 296-303.

53. Chiang, K. T., Switzer, C. H., Akali, K. O. and Fukuto, J. M. (2000) The Role of Oxygen and Reduced Oxygen Species in Nitric Oxide (NO)-Mediated Cytotoxicity: Studies in the Yeast *Saccharomyces cerevisiae* Model System, *Tox. Appl. Pharmacol.*, 167, 30-36.

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Book Edited:

1. "Signal Transduction by Reactive Oxygen and Nitrogen Species: Pathways and Chemical Principles", edited by Henry J. Forman, Jon M. Fukuto and Martine Torres, Kluwer Academic Publishers, Boston, 2003.

Patents:

1. Wink, David A.; Feelisch, Martin; Kass, David A.; Paolocci, Nazareno; Miranda, Katrina; Fukuto, Jon;

Katori, Tatsuo. Nitroxyl progenitors in the treatment of heart failure. United States Patent 20040039063 (2004)

2. Wink, David A.; Miranda, Katrina M.; Bradbury, Christopher M.; Gius, David; Fukuto, Jon M.; Feelisch, Martin. Cyclooxygenase 2 inhibition with nitroxyl for treating COX-2-mediated conditions. United States Patent 20040038947 (2005)

3. Wink, D. A., Feelisch, M., Pagliaro, P., Kass, D. A., Paolocci, N., Miranda, K. M. and Fukuto, J. M. Method for treating ischemia reperfusion injury with nitroxyl donors, United States Patent, 8268890 (2012)

<u>Invited Oral Presentations</u>:

1. "Studies on the Reaction Pathway and Mechanism of NO Biosynthesis", Department of Chemical Pharmacology, Faculty of Pharmaceutical Sciences, Meijo University, Nagoya, Japan, October 26, 1992.

2. "The Mechanism of NO Biosynthesis", Department of Pharmacology, Keio University School of Medicine, Tokyo, Japan, October 27, 1992.

3. "The Mechanism of Nitric Oxide Synthesis" Department of Pharmacology, UCLA School of Medicine, CHS, Los Angeles, CA, September 30, 1992.

4. "The Pharmacology of Nitric Oxide", Grand Rounds, Department of Neurology, Harbor General Hospital, Torrence, CA, January 22, 1993.

5. "The Mechanism and Reaction Pathway of Nitric Oxide Biosynthesis", Bay Area Free Radical Society Conference, Ritz-Carlton Hotel, Pasadena, CA, March 12, 1993.

6. "Chemical Studies on the Reaction Pathway and Mechanism of Nitric Oxide Biosynthesis", Environmental Toxicology Program, University of California, Riverside, May 6, 1993.

7. "The Pharmacology and Biochemistry of Nitric Oxide", Department of Chemistry and Biochemistry, California State University, Los Angeles, CA, Jan. 28, 1994.

8. "The Chemistry of Nitric Oxide", Biochemistry and Molecular Biology of Nitric Oxide Conference, Los Angeles, CA, July 16, 1994.

9. “The Role of Thiols in NO-Mediated Cytotoxicity”, at the 1st Gordon Research Conference on Nitric Oxide Biochemistry and Biology, Ventura, California, January 29-February 3, 1995.

10. “The Chemistry and Biochemistry of NO-Mediated Cytotoxicity”, Department of Chemistry, Inorganic Division, University of California at Santa Barbara, May 10, 1995.

11. "Modeling the Biosynthesis of NO" Symposium on the Bioinorganic Chemistry of Nitrogen Oxides, ACS National Meeting, New Orleans, March 24-29, 1996.

12. "The Conversion of Arginine to Citrulline and Nitric Oxide (NO) by Nitric Oxide Synthase", 11th International Symposium on Microsomes and Drug Oxidations, Los Angeles, July 21-24, 1996.

13. "The Biosynthesis and Biological Activity of NO and N-Hydroxy-L-Arginine", Pfizer Chemical Co., Groton, CT, August 21, 1997.

14. "The Reaction of NO with Biological Molecules and the Generation of Novel Intermediates", ASPET/SEPS colloquium on the Biology and Chemistry of Nitric Oxide, Augusta, GA, Oct. 4-6, 1997.

15. "The Chemistry and Pathophysiology of Nitric Oxide and Nitroxyl (HNO)", Department of Medicinal Chemistry, University of Minnesota, February 9, 1999.

16. "The Physiological Chemistry of Nitric Oxide (NO) and Related Species", Department of Chemistry, Organic Division, UCLA, February 25, 1999.

17. “NO and Metal Metabolism: An Examination Using the Yeast Model System”, Oxygen Club of California World Congress: Biological Oxidants and Antioxidants, Santa Barbara, March 1-4, 2000.

18. “NO-Mediated Cytotoxicity and Effects on Metal-Responsive Transcription Factors”, University of California, Riverside, Environmental Toxicology Department, April 4, 2001.

19. “The Chemistry and Pathophysiology of NO and HNO”, Presentation at the American Chemical Society Western Regional Meeting, Nitric Oxide Symposium, Santa Barbara, CA, Oct. 28-31, 2001.

20. “The Effect of Nitric Oxide (NO) on Copper Regulatory Proteins in Yeast", 3rd International Meeting on Copper Homeostasis and its Disorders: Molecular and Cellular Aspects", Ischia Porto, Italy, October 4-8, 2002.

21. "The Chemistry and Biochemistry of Nitroxyl (HNO): A Novel Nitrogen Oxide with Important Pharmacology and Physiology", University of California, Santa Barbara, Inorganic Chemistry Division, Nov. 6, 2002.

22. “Examination of Nitrogen Oxides using a Yeast Model System”, Current Topics in Redox Biosignaling and Stress Responses, Sponsored by Kumamoto University, Hotel Nikko, Kumamoto, Japan, May 27-28, 2003

23. "Studies on the Chemistry and Fate of the Enigmatic Nitrogen Oxide, Nitroxyl (HNO)", The 3rd Annual Meeting of the Nitric Oxide Society of Japan, Kumamoto, Japan, May 29-30, 2003.

24. “The Chemistry and Biochemistry of the Forgotten Nitrogen Oxide, Nitroxyl (HNO): A Novel Agent for the Treatment of Heart Failure”, University of Tokyo, Department of Pharmaceutical Sciences, June 2, 2003.

25. "The Chemistry and Biochemistry of Nitric Oxide and Related Species", Dept. of Chemistry and Biochemistry, California State University, Fullerton, Nov 13, 2003.

26. "The Physiological Chemistry and Vascular Biology of Nitroxyl (HNO), UCLA Cardiovascular Training Program Seminar Series, Dec. 11, 2003.

27. "The Chemistry and Biology of HNO", Mesilla Conference on the Chemistry of NO in Biological Signaling, Mesilla, New Mexico, Feb. 2. 2004.

28. "The Chemistry and (Patho)physiology of NO, HNO and Related Nitrogen Oxides", Department of Chemistry Seminar, University of Florida, Gainesville, Oct. 29, 2004.

29. "The Chemistry and Biology of NO, HNO and Related Nitrogen Oxides", Inorganic and Organic Chemistry Department Seminar, University of California, Santa Cruz, Dec. 6, 2004.

30. “The Chemistry and Biology of Nitrogen Oxides”, Environmental Health Sciences Department, UCLA, Oct. 6, 2005.

31. "Thiols and Thiolproteins as Targets for the Actions of Nitrogen Oxides", Keynote Address, 6th Annual UK Nitrogen Oxide Forum, London, England, Dec. 19, 2005.

32. "Reactive Nitrogen Oxide Species in Signal Transduction", Oxygen Radicals Gordon Conference, Ventura, California, Feb. 5, 2006.

33. "The Biological Chemistry of Nitric Oxide, Nitroxyl and Related Nitrogen Oxides" Chemistry Colloquium, Department of Chemistry, Johns Hopkins University, Baltimore, MD, April 25, 2006.

34. "The Chemistry, Biochemistry and Pharmacology of Nitroxyl and other Nitrogen Oxide Species", Summer Scholar Program, Department of Chemistry and Biochemistry, Loyola Marymount University, Los Angeles, CA, Sept. 15, 2006.

35. "The Chemistry, Biochemistry and Pharmacology of Nitrogen Oxides", Chemistry Department Seminar, Sonoma State University, Feb. 15, 2007.

36. “The Chemical Biology and Pharmacology of Nitric Oxide (NO) and Nitroxyl (HNO)”, Keynote Lecture, 19th Northern California ACS Undergraduate Research Symposium, May 5, 2007.

37. “The Biology and Chemistry of Nitrogen Oxides”, Department of Biology, Sonoma State University, Sept. 9, 2008.

38. “The Chemistry of HNO: NO’s Alter Ego”, Nitric Oxide Gordon Conference, Barga Italy, March 9, 2009.

39. “The Chemistry and Biology of Nitrogen Oxide Signaling and Physiology”, Department of Chemistry, University of Maryland, Baltimore County, Oct. 27, 2009.

40. “The Biological Chemistry of Nitroxyl and Physiological Implications”, First Nitroxyl-Nitric Oxide Symposium: From Chemistry Aspects to Basic Regulations, Ribeirao Preto, Brazil, Nov. 12, 2009.

41. “Studies on the Chemical Biology of Hydrogen Sulfide (H_2S)” Department of Chemistry, Instituto de Quimica de Sao Carlos, SP, Brazil, Nov. 13, 2009.

42. “The Chemistry and Physiology of the Enigmatic Nitrogen Oxide HNO”, Department of Chemistry, University of California, Davis, March 9, 2010.

43. “The Chemical Biology and Therapeutic Potential of Nitroxyl (HNO)”, Department of Chemistry, San Francisco State University, April 9, 2010.

44. “The Chemical Biology of HNO: Comparison with other Nitrogen Oxides” The 6th International Conference on the Biology, Chemistry and Therapeutic Applications of Nitric Oxide, Kyoto, Japan, June 15, 2010.

45. “The Chemical Biology of the Small Molecule Signaling Species (NO, CO and H_2S)”, University of California, Riverside, Environmental Toxicology Program, May 30, 2012.

46. “A Comparison of the Chemical Biology of Nitroxyl (HNO) and Nitric Oxide (NO)”, Departamento de Química, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil, 6/14/12.

47. “The Chemical Biology of Nitroxyl (HNO) and Nitric Oxide (NO): Comparison and Contrast”, Departamento de Química e Física Molecular, Instituto de Química de São Carlos, Universidade de São Paulo, Brazil, 6/19/12.

48. “The Biological Targets and Chemistry of Nitroxyl (HNO) and Nitric Oxide (NO)”, Universidade Federal do Ceará, Departamento de Química Orgânica e Inorgânica, Fortaleza, CE, Brazil, 6/21/12.

49. “The Reaction of HNO with Nitrogen Oxides and other Biologically Relevant Species”, presented at the 7th International Congress on the Biology, Chemistry and Therapeutic Application of Nitric Oxide, Edinburgh Scotland, July 22-26, 2012.

50. “The Biology of Hydrogen Sulfide: Persulfide Generation and Activity”, Department of Chemistry, San Francisco State University, September 21, 2012.

51. "The Chemical Biology of Nitric Oxide (NO) and Nitroxyl (HNO)", Department of Chemistry, San Jose State University, October 23, 2012.

52. “The Chemical Biology of Nitrogen Oxide Signaling”, The 85th Annual Meeting of the Japanese Biochemical Society, Fukuoka, Japan, Dec. 16, 2012.

53. “The Chemical Biology of Hydrogen Sulfide”, International Symposium on Signaling Functions of Reactive Oxygen Species, Fukuoka, Japan, Dec. 17, 2012.

54. “The Chemical Biology of Hydrogen Sulfide: Generation of Persulfides and Possible Functions”. MEXT Symposium “Signaling Functions of Reactive Oxygen Species”, Kumamoto, Japan, Dec. 18, 2012.

55. “The Chemical Biology of Small Molecule Signaling Agents”, COST European Network on Gasotransmitters, 2nd Working Group Meeting, Smolenice, Slovakia, April 11, 2013.

56. “Persulfide Chemistry and Biology”, University of Tskuba, Japan, Dept. of Environmental Medicine, Tskuba, Japan, March 19, 2014.

57. “The Chemical Biology of H_2S and Derived Species”, Society for Free Radical Research International (SFRRI) 17th biennial meeting, Kyoto, Japan, March 23-26, 2014.

58. “The Integrated Chemistry and Biology of Small Molecule Signals”, COST European Network Meeting on Gasotransmitter Biology and Chemistry, Isola de Capri, Italy, March 29, 2014.

<u>Current Funding</u>:

“Biological Chemistry and Pharmacology of Nitroxyl (HNO)”, PI, NIH R15, 8/1/2011 – 7/31/2014, $356,987 direct costs.

“The Chemical Biology of Hydrogen Sulfide”, PI, NSF RUI, 2/1/2012 – 1/31/2015, $300,000 direct costs.

Mark J. Perri

Assistant Professor

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EDUCATION

Ph.D. Chemistry, May 2004

University of California, Berkeley

Dissertation: *Investigation of the Triple Oxygen Isotope Anomaly in Stratospheric CO_2 through Crossed Molecular Beam Experiments*

Research Advisor: Professor Kristie A. Boering

B.S. Chemistry (with Distinction), May 1998

Harvey Mudd College, Claremont, California

Thesis: *Diblock Copolymers Studied Under Shear Conditions Using Neutron Reflectivity*

Research Advisor: Professor Shenda M. Baker

EMPLOYMENT

8/09 – present	Assistant Professor, Department of Chemistry, Sonoma State University, Rohnert Park, CA
1/07 – 7/09	Post-Doctoral Associate, Center for Environmental Prediction / Department of Environmental Sciences / Institute for Marine and Coastal Sciences Department of Environmental Sciences, Rutgers, The State University of New Jersey, New Brunswick, NJ
Fall 2006	Adjunct Professor and Lab Instructor Brookdale Community College, Lincroft, NJ
5/04 – 6/05	Post-Doctoral Associate, Department of Physics Western Michigan University / Lawrence Berkeley National Lab, Berkeley, CA
8/98 – 5/04	Graduate Research Assistant, Department of Chemistry Teaching Assistant, Department of Chemistry (3 semesters) University of California, Berkeley, Berkeley, CA
Summer 2003	Chemistry instructor for CAL-MESA (Mathematics, Engineering, Science Achievement) program University of California, Berkeley, Berkeley, CA
8/94 – 5/98	Undergraduate Research Assistant, Department of Chemistry (2 years), Advisors Dr. Baker and Dr. Van Hecke Teaching Assistant (3 semesters) Harvey Mudd College, Claremont, CA

TEACHING EXPERIENCE

Sonoma State University:

Spring 2014	Chemistry 255	Quantitative Analysis (Lecture and Lab)
	Chemistry 401	Senior Integrated Lab (Lab)
	Chemistry 496	Selected Topics: Atmospheric Chemistry (Lecture)*
Fall 2013:	On Leave	
Spring 2013:	Chemistry 125B	Quantitative General Chemistry (Lab)
	Chemistry 255	Quantitative Analysis (Lab)
	Chemistry 310B	Fundamentals of Physical Chemistry (Lecture)
Fall 2012:	Chemistry 125A	Quantitative General Chemistry (Lab)
	Chemistry 275	Instrumental Analysis (Lecture)*
	Chemistry 310A	Fundamentals of Physical Chemistry (Lecture)
Spring 2012:	Chemistry 125B	Honors Analytical & General Chemistry (Lecture and Lab)
	Chemistry 310B	Fundamentals of Physical Chemistry (Lecture)
Fall 2011:	Chemistry 125A	Honors Analytical & General Chemistry (Lecture and Lab)
	Chemistry 310A	Fundamentals of Physical Chemistry (Lecture)
Spring 2011:	Chemistry 125B	Honors Analytical & General Chemistry (Lecture and Lab)
	Chemistry 316	Fundamentals of Physical Chemistry (Lab)
Fall 2010:	Chemistry 102	Chemistry and Society (Lecture and Lab)
	Chemistry 125A	Honors Analytical & General Chemistry (Lecture and Lab)
	Chemistry 401	Instrumental Analysis and Chemical Synthesis (Lecture and Lab)

Spring 2010:	Chemistry 102	Chemistry and Society (Lecture and Lab)
	Chemistry 316	Fundamentals of Physical Chemistry (Lab)
Fall 2009:	Chemistry 255	Quantitative Analysis (Lecture and Lab)
	Chemistry 401	Instrumental Analysis and Chemical Synthesis (Lecture and Lab)

* New course at SSU

Brookdale Community College:

Fall 2006: Adjunct Professor and Lab Instructor

Courses Taught: Chemistry in the Environment (Lecture and Lab), General Chemistry Lab, Inorganic, Organic, and Biochemistry Lab

UC Berkeley:

Summer 2003: Chemistry instructor for CAL-MESA (Mathematics, Engineering, Science Achievement) program. The MESA program is designed to prepare educationally disadvantaged students for High School.

Fall 2000: Teaching Assistant: General Chemistry

Fall 1999: Teaching Assistant: Physical Chemistry Laboratory

Fall 1998: Teaching Assistant: General Chemistry

Harvey Mudd College:

Fall 1997: Teaching Assistant: General Chemistry Laboratory

Spring 1996: Teaching Assistant: General Chemistry Laboratory

Fall 1996: Teaching Assistant: Physical Chemistry

STUDENT RESEARCHER MENTORING

Erin Ballantyne	Quantification of Pesticides in our environment, 2013 – 2014
Shelby Triplett	Quantification of Pesticides in our environment, Summer 2013
Michael Haggmark	Quantification of Pesticides in our environment, 2013 – 2014
Ben Diamond	Quantification of Pesticides in our environment, 2013 – 2014
Sam Hall	Detection and Quantification of Atmospheric Trace Gases, 2013
Justine Gray	Degradation of Antibiotics, 2013 – 2014
Ashley Savio	Analysis of Anions in the Copeland Creek, 2012
Brian Coverston	Interfacing Gas Chromatographs with PCs using Labview, 2011 – 2012
Sara Rigney	Chemical Fate of Antibiotics in our Water Supply, 2011 – 2012
Garrett Wilson	Chemical Fate of Antibiotics in our Water Supply, 2011 – 2012
Chong Her	Analysis of Anions in the Copeland Creek, 2011 – 2012
Bella Neufeld	Analysis of Anions in the Copeland Creek, 2011 – 2013
Ross Mohs	Detection and Quantification of Atmospheric Trace Gases: Ethanol and its Oxidation Products. Undergraduate researcher, 2010 – 2013
Deva Borthwick	Summer High School STEM Internship Program, 2010
Jamie Goldfield	Summer High School STEM Internship Program, 2010

Kirstin Rosland	FTICR analysis of Atlanta atmospheric aerosols, 2009 – 2013
Rachele Pendergrass	Chemical Education: How access to state of the art instruments affects student learning, 2009 – 2011
Tisa Gilbert	Detection and Quantification of Atmospheric Trace Gases: Ethanol and its Oxidation Products. Undergraduate researcher, 2009 – 2011
Kellie Ginnodo	Detection and Quantification of Atmospheric Trace Gases: Ethanol and its Oxidation Products. Undergraduate researcher, 2009 – 2010
Chris Hoff	Prediction and Control of Ground Level Ozone using the EPA Community Multiscale Air Quality Model (CMAQ). Undergraduate researcher, 2009 – 2011
Mary Moore	Incorporation of unexpected high molecular weight products involved in the OH oxidation of glyoxal into a cloud chemistry model. Undergraduate researcher, Department of Environmental Sciences, 2008 – 2009

RESEARCH INTERESTS

Vision: To improve the scientific understanding needed to predict the impacts of anthropogenic activity on the atmosphere and on our climate, including the effects of large scale fuel ethanol use

Motivation: Large scale fuel ethanol use has the potential to drastically alter the composition of volatile organic carbon emissions, affecting the chemistry of our atmosphere, air quality, and public health.

Methods: Sampling of ethanol and its oxidation products in ambient air with analysis by Gas Chromatography and Ion Chromatography; aqueous ethanol oxidation experiments with analysis by Electrospray Ionization Mass Spectrometry, Ion Chromatography, and High Pressure Liquid Chromatography

PAST RESEARCH EXPERIENCE

1/07 – 7/09 Post-Doctoral Researcher, Department of Environmental Sciences, Rutgers, The State University of New Jersey

Studying the formation of secondary organic aerosol via aqueous cloud processing of organic pollutants. Specifically, the kinetics of the aqueous reaction of glycolaldehyde + hydroxyl radical are studied by analyzing product composition and concentration as a function of time using Electrospray Mass Spectrometry, Fourier Transform Ion Cyclotron Resonance Mass Spectrometry, Ion Chromatography, and Total Organic Carbon Analysis. Results are compared to a cloud chemistry model and used to estimate quantities of secondary organic aerosol produced from cloud processing of glycolaldehyde.

5/04 – 6/05 Post-Doctoral Researcher, Department of Physics

Western Michigan University / Lawrence Berkeley National Lab

Designed and built an ion imaging system for analysis of small molecules using dissociative photoionization with coincident electron detection for time of flight determination. This system is currently in use at LBNL to study the dynamics of small molecules of atmospheric importance as well as the dynamics of large cluster dissociations.

8/98 – 5/04 Graduate Research Assistant, Department of Chemistry

University of California, Berkeley

Utilized crossed molecular beam experiments involving both an ion-imaging setup and a universal quadrupole detector to study the isotope exchange between $O(^1D)$ and CO_2. This work resulted in determination of the mechanism of isotope exchange between oxygen atoms and carbon dioxide in the Earth's stratosphere. A new, unanticipated reaction pathway was discovered that potentially impacts the analysis of data concerning ozone loss processes.

Responsible for setting up our laboratory for isotopic analysis of stratospheric gas samples collected from NASA, including setup of a Finnigan MAT-252 Isotope Ratio Mass Spectrometer and modification of a commercial gas chromatography system to separate and collect O_2 and N_2 from ambient air samples. The results from analysis of atmospheric gas samples demonstrated that measurements of the isotopic composition of stratospheric CO_2 could be used to deduce information regarding production and transport of ozone in the stratosphere. It was also determined that measurement of the isotopic composition of tropospheric CO_2 yields a relatively simple way to study the exchange of carbon between the atmosphere and biosphere, which is a key element in understanding the role of gross primary production in global warming.

5/97 – 5/98 Undergraduate Research Assistant, Department of Chemistry

Harvey Mudd College

Studied diblock copolymers under shear conditions using neutron reflectivity at Los Alamos National Laboratory in order to determine the effects of various solvents on polymer adsorbates. Wrote a computer program to analyze the data collected.

1/96 – 12/96 Undergraduate Research Assistant, Department of Chemistry

Harvey Mudd College

Developed a technique to measure thermodynamic parameters of binary liquid solutions by laser interferometry.

PEER-REVIEWED LITERATURE

Ortiz-Montalvo, D. L.; Lim, Y. B.; Perri, M. J.; Seitzinger, S. P.; Turpin, B. J., "Volatility and Yield of Glycolaldehyde SOA Formed through Aqueous Photochemistry and Droplet Evaporation," Aerosol Science and Technology (2012), 46 (9), 1002-1014.

Perri, M.J., Y.B. Lim, S.P. Seitzinger, B.J. Turpin, "Organosulfates from glycolaldehyde in aqueous aerosols and clouds: Laboratory studies," Atmospheric Environment (2010), doi:10.1016/j.atmosenv.2010.03.031

Lim, Y.B., Tan, Y., Perri, M.J., Seitzinger, S.P. and Turpin, B.J., 2010. Aqueous chemistry and its role in secondary organic aerosol (SOA) formation. Atmos. Chem. Phys. Discuss. 10, 14161-14207.

Tan, Y., Perri, M.J., Seitzinger, S.P. and Turpin, B.J., 2009. Effects of Precursor Concentration and Acidic Sulfate in

Aqueous Glyoxal-OH Radical Oxidation and Implications for Secondary Organic Aerosol. Environmental Science & Technology 43, 8105-8112.

Lim, Y.B., Tan, Y., Perri, M.J., Altieri, K. and Turpin, B.J., 2009. Secondary organic aerosol formation through reactions in atmospheric waters. Geochimica Et Cosmochimica Acta 73, A764-A764.

Perri, M.J., Seitzinger, S. and Turpin, B.J., 2009. Secondary organic aerosol production from aqueous photooxidation of glycolaldehyde: Laboratory experiments. Atmospheric Environment 43, 1487-1497.

D. Rolles, Z.D. Pesic, M. Perri, R.C. Bilodeau, G.D. Ackerman, B.S. Rude, A.L.D. Kilcoyne, J.D. Bozek, N. Berrah, "A velocity map imaging spectrometer for electron-ion and ion-ion coincidence experiments with synchrotron radiation," Nuclear Instruments & Methods in Physics Research Section B-Beam Interactions with Materials and Atoms, 261(1-2) 170, 2007

Z.D. Pesic, D. Rolles, M. Perri, R.C. Bilodeau, G.D. Ackerman, B.S. Rude, A.L.D. Kilcoyne, J.D. Bozek, N. Berrah, "Velocity map ion imaging applied to studies of molecular fragmentation with synchrotron radiation," Journal of Electron Spectroscopy and Related Phenomena, 155 (1-3) 155, 2007

R.C. Bilodeau, N.D. Gibson, J.D. Bozek, C.W. Walter, G.D. Ackerman, P. Andersson, J.G. Heredia, M. Perri, N. Berrah, "High-charge-state formation following inner-shell photodetachment from S^-," Physical Review A, 72(5) 050701, 2005.

M.J. Perri, A.L. Van Wyngarden, K.A. Boering, J.J. Lin, and Y.T. Lee, "Energy Dependence of the Oxygen Isotope Exchange and Quenching in the $O(^1D) + CO_2$ Reaction: A Crossed Molecular Beam Study," The Journal of Physical Chemistry A, 108(39) 7995, 2004.

K.A. Boering, T. Jackson, K.J. Hoag, A.S. Cole, M.J. Perri, M. Thiemens, E. Atlas, "Observations of the anomalous oxygen isotopic composition of carbon dioxide in the lower stratosphere and the flux of the anomaly to the troposphere," Geophysical Research Letters 31(3), 2004.

M.J. Perri, A.L. Van Wyngarden, K.A. Boering, J.J. Lin, and Y.T. Lee, "Dynamics of the $O(^1D) + CO_2$ oxygen isotope exchange reaction," J. Chem. Phys 119(16) 8213, 2003.

ORAL CONFERENCE PRESENTATIONS

Lim, Y.B., Tan, Y., Perri, M.J., Altieri, K. and Turpin, B.J., 2009. Secondary organic aerosol formation through reactions in atmospheric waters. Geochimica Et Cosmochimica Acta 73, A764-A764.

Altieri, K.E., Perri, M.J., Turpin, B.J., Seitzinger, S.P., “In-Cloud Photochemistry Produces Complex DOM,” American Geophysical Union/American Society of Limnology and Oceanography, Ocean Sciences Conference, Orlando, FL, March 2008

M.J. Perri, S.P. Seitzinger, Y. Tan, B.J. Turpin, “SOA Production From Cloud Processing of Glycolaldehyde,” Daytime and Nighttime Chemical Processing in Polluted Atmospheres II, American Geophysical Union Fall Meeting, San Francisco, CA, December 10-14, 2007

J.J. Lin, M.J. Perri, A.L. Van Wyngarden, K.A. Boering, Y.T. Lee, “Reaction dynamics of isotope exchange reaction of singlet oxygen atom with carbon dioxide molecule: A crossed molecular beam study,” Chemical Physics in Atmospheric Science, American Chemical Society National Meeting, Philadelphia, PA, August 2004.

A.L. Van Wyngarden, M.J. Perri, A.M. Mebel, J.J. Lin, Y.T. Lee, K.A. Boering, “Dynamics of CO_2+$O(^1D)$ and implications for isotope exchange between O_3 and CO_2,” Sci-Mix, American Chemical Society National Meeting, Philadelphia, PA August 2004.

M.J. Perri, A.L. Van Wyngarden, D.S. Peterka, K.A. Boering, M. Ahmed, “Velocity Map Imaging of the Reactions O + CO_2 and O + N_2,” Frontiers in Chemical Dynamics -- Dynamics of Radical Reactions II, American Chemical Society National Meeting, Orlando, FL, April 6 - 11, 2002.

A.L.Van Wyngarden, M.J. Perri, D.S. Peterka, K.A. Boering, M. Ahmed, “Photodissociation dynamics with velocity map imaging (VELMI),” Frontiers in Chemical Dynamics -- Dynamics of Radical Reactions II, American Chemical Society National Meeting, Orlando, FL, April 6 - 11, 2002.

INVITED SEMINARS

M.J. Perri, “Organosulfate Formation from Glycolaldehyde” UC Davis. November 22, 2010.

M.J. Perri, “Undergraduate Research in Atmospheric Chemistry at SSU”. November 16, 2009.

M.J. Perri, B.J. Turpin, “Indoor Air Quality” Rutgers - Chinese Academy of Sciences Collaboration Workshop. November 13-15, 2008. Guangzhou Institute of Geochemistry and the South China University of Technology in Guangzhou, China.

M.J. Perri, A.L. Van Wyngarden, D.S. Peterka, K.A. Boering, M. Ahmed, “Velocity Map Imaging of the Reactions O + CO_2 and O + N_2,” Lawrence Livermore National Laboratory, 2004.

POSTERS

B. Neufeld and M.J. Perri, "The Impact of Sonoma State University on the Water Quality of Copeland Creek Using Ion Chromatography," SSU Science Symposium, Sonoma State University, April, 2013.

M.J. Perri, C. Hoff, R. Mohs, B. Neufeld, S. Moltchanoff, “Measurements and Modeling of Rohnert Park’s Air and Water Quality,” Sonoma State University Faculty Research Exposition, March 27, 2013

S.Moltchanoff , C. Hoff, and M.J. Perri, “Evaluation of the Community Multiscale Air Quality Model,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

M.J. Perri, C. Hoff, R. Mohs, “Atmospheric Chemistry: Effect of Local Pollutants on the Troposphere,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

R. Mohs and M.J. Perri, “Measurements and Predictions of Local Air Pollution,” Sonoma State University Faculty Research Exposition, March 7, 2012

P. Ko, K.E. Altieri, M.J. Perri, S.P Seitzinger, B.J. Turpin, “The Effect of Nitric Acid on Cloud Processing of Glyoxal,” Research Internships in Ocean Sciences Presentation, August, 2008.

M.J. Perri, A.L. Van Wyngarden, K.A. Boering, J.J. Lin, and Y.T. Lee, ”Dynamics of the $O(^1D) + CO_2$ oxygen isotope exchange reaction,” UC Berkeley Atmospheric Science Center Symposium, October 10, 2003, Berkeley, California.

M.J. Perri, A.L. Van Wyngarden, K.A. Boering, J.J. Lin, and Y.T. Lee, ”Dynamics of the $O(^1D) + CO_2$ oxygen isotope exchange reaction,” Dynamics of Molecular Collisions, July 13-18, 2003, Lake Tahoe, California.

M.J. Perri, A.L. Van Wyngarden, K.A. Boering, J.J. Lin, and Y.T. Lee, “Crossed Molecular Beam Studies of $O(^1D) + CO_2$: Results and Implications for the Atmosphere,” Western Spectroscopy Association, January 29-31, 2003, Asilomar, California.

A.S. Cole, A.L. Van Wyngarden, M.J. Perri, J.J. Lin, Y.T. Lee, K.A. Boering, “Investigating Transfer of the Oxygen Isotope Anomaly from O_3 to CO_2,” American Geophysical Union, December 6-10, 2002, San Francisco, California.

M.J. Perri, A.L. Van Wyngarden, D.S. Peterka, K.A. Boering, M. Ahmed, “Velocity Map Imaging of O

+ CO_2 and O + N_2,” Western Spectroscopy Association Conference, January 30 - February 1, 2002, Asilomar, California.

M.J. Perri, K.J. Hoag, A.S. Cole, K.A. Boering, C.A. Brenninkmeijer, T.Rockmann, “Towards Measurement of Anomalous Oxygen Isotope Fractionation in CO_2 from Stratospheric Whole Air Samples,” UC Berkeley Atmospheric Science Center Symposium, November 9, 2001, Berkeley, California.

FUNDING

M.J. Perri (2014). Measurements of organic pesticides in our local environment. WATERS collaboration funds, $1650

M. Haggmark (2013). Measurements of organic pesticides in our local environment. Instructionally Related Activity – research award, $750

M.J. Perri (2013). Measurements of organic pesticides in our local environment. Provost Professional Development Funds, $1000

M.J. Perri (2013). Measurements of organic pesticides in our local environment. SST Professional Development Funds, $1969

M.J. Perri (2013). Measurement of Anion Concentrations in Copeland Creek. WATERS collaboration funds, $1250

M.J. Perri (2012). Measurement of Anion Concentrations in Copeland Creek. SST Professional Development Funds, $2300

M.J. Perri (2012). Organic Pollutants in Copeland Creek. Sonoma State University RSCAP, $2677

M.J. Perri (2012). Development of a Community Chemistry Cluster. NSF Transforming Undergraduate Education, $200,000 (denied)

S. Moltchanoff and M.J. Perri (2012). Evaluation of the Community Multiscale Air Quality Model NASA Spacegrant / MESA Summer Research Award, $3000

R. Mohs and M.J. Perri (2012). Atmospheric Chemistry: Effect of Local Pollutants on the Troposphere NSF STEM Summer Research Award, $3000

M.J. Perri (2011). Impact of Alternative Transportation on our Local Air Quality. Sonoma State University RSCAP, $4365

M.J. Perri (2011). Impact of Alternative Transportation on our Local Air Quality. SST Professional Development Funds, $1000

M. Weisman, M.J. Perri (2011). Investigation of the Copeland Creek Water Quality. part of the SSU Service Learning Grant, $1537

M.J. Perri (2011). Travel Grant to Attend WRF Tutorial. SST Professional Development Funds, $1500

M.J. Perri (2011). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. SST Professional Development Funds, $1000

M.J. Perri (2011). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. SST

Professional Development Funds, $1424

M.J. Perri (2010). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. Sonoma State University RSCAP, $3232

M.J. Perri (2009). Predicting Future Trends in Ground Level Ozone in the North Bay and US Region. Sonoma State University RSCAP, $1840

SERVICE

Fall 2012 – Spring 2013	Liaison to Sonoma County Science Fair held at SSU
Summer 2012	Administration and Finance Conversion Committee
Fall 2011 – present	Academic Senate Budget Subcommittee
Fall 2010 – Spring 2013	School of Science and Technology Travel Committee
Fall 2010 – Spring 2013	Chemistry Club Advisor
Spring 2009 – present	Maintaining Chemistry Department Web Page
Fall 2009 – present	Academic Advisor
Fall 2009 – present	Chemistry Department Curriculum Committee
Summer 2010	SOAR advisor
Summer 2010	Temporary Faculty Hiring Committee
Spring 2010	Volunteer to help with science demonstrations for Hahn Elementary Science Night
Fall 2009 – Spring 2010	Volunteer coach for Rancho Cotate High School Debate Team
Fall 2009	Volunteer to help with science demonstrations for Roseland Elementary School on National Chemistry Day
Fall 2009 – Spring 2013	Lead department efforts in revision of department catalog copy

Monica Rae Jung Lares

Assistant Professor

Department of Chemistry and Biochemistry

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EDUCATION

Postdoctoral Fellow, Molecular and Cell Biology, City of Hope, Duarte, California **2010-2013**

Working on cell specific delivery of therapeutic siRNA, Dr. John Rossi (PI)

Ph. D., Chemistry and Biochemistry, University of California, Santa Cruz, California **2009**

Dissertation: *Towards the structure and function of a novel RNA gene*, Dr. William G. Scott (PI), Dr. Gene Switkes, Dr. Theodore R. Holman, Dr. David Haussler

B. S., Chemistry, Santa Clara University, Santa Clara, California **2003**

TEACHING

TEACHING EXPERIENCE

Undergraduate Research 494, Chemistry, Sonoma State University, Rohnert Park, CA Lab; (1-6 units) **2013-2014**

General Chemistry 115A, Chemistry, Sonoma State University, Rohnert Park, CA **Spring 2014**

Biochemical Methods 441, Chemistry, Sonoma State University, Rohnert Park, CA **Spring 2014**

Metaboli Biochemistry 446, Chemistry, Sonoma State University, Rohnert Park, CA **Spring 2014**

Research Seminar 497, Chemistry, Sonoma State University, Rohnert Park, CA **Spring 2014**

Elements of General, Organic, and Biochemistry 105, Chemistry, Sonoma State University, Rohnert Park, CA Lecture and Lab; (5 units) **Fall 2013**

Chemistry Seminar Series 492, Chemistry, Sonoma State University, Rohnert Park, CA; (1unit) **Fall 2013**

Introduction to General, Organic, and Biological Chemistry, Chemistry 32B, **Fall 2009**

San Jose City College, San Jose, CA; Planned lectures and labs for a class of 30 Students in organic and biological chemistry.

General Chemistry 1L & 1M, Chemistry, University of California, Santa Cruz, CA **Summer 2005**

Provided lab assistance for an intro general chemistry lab for groups of 15 students

General Chemistry and Organic Chemistry **2004-2005**

Provided one on one training, mentoring, and tutoring

Organic Chemistry 108M, Chemistry, University of California, Santa Cruz, CA **Spring 2004**

Provided lab assistance for an intro organic chemistry lab for groups of 15 students

Organic Chemistry 108L, Chemistry, University of California, Santa Cruz, CA **Winter 2004**

Provided lab assistance for an intro organic chemistry lab for groups of 15 students

Organic Chemistry 108A, Chemistry, University of California, Santa Cruz, CA **Fall 2003**

Provided guidance for a group of 30 students weekly

CURRICULUM AND COURSE DEVELOPMENT

Metabolic Chemistry (CHEM 446)- developed literature assignments that required students to utilize and become familiar with a useful on-line database (Protein Data Bank). Clicker questions were also incorporated into my lectures and students reported their answers with Poll Everywhere, which allowed the whole class to see their peers answers instantly and anonymously.

ACADEMIC ADVISING

Met with students to discuss and develop a four year plan. I currently have 13 advisees

Advise the random biology major from my general chemistry classes

FELLOWSHIPS (AND AWARDS)

UC Santa Cruz, Graduate Division, Graduate Research Mentorship Program Fellow **2008-2009**

Initiative for Maximizing Student Diversity (IMSD) Fellow **2007-2008**

Center for Biomolecular Science and Engineering Fellow **2005-2007**

Cota-Robles Fellow **2003-2005**

PROFESSIONAL SOCIETIES

American Association for the Advancement of Science, member **2007-2013**

Alliance for Graduate Education and the Professoriate (AGEP), member **2006-2009**

American Chemical Society, member **2002-**

Society for the Advancement of Chicanos and Native Americans in Science, member **2001-**

SCHOLARSHIP

PROJECT EXPERIENCE

Binding of BAFF Receptor Protein and its RNA aptamer, Sonoma State University, **Principal Investigator 2014**

We are working on identifying key interactions between the B-cell-activating factor receptor (BAFF-R) protein and a RNA aptamer that specifically binds BAFF-R. BAFF-R is expressed on B-cells and overexpressed in non-Hodgkin's lymphoma. When BAFF-R's ligand, B-cell-activating factor (BAFF), binds, proliferation and cell survival increase allowing the cancer to spread faster. Aptamers are capable of binding their targets with high specificity and affinity and have recently been investigated for their therapeutic advantages over antibody-based approaches. An RNA aptamer has been identified that efficiently binds BAFF-R, thus preventing binding of its ligand. The RNA aptamer has also been used to deliver therapeutic reagents that kill the cell. We are working on identifying the specific amino acids of BAFF-R that are responsible for the binding of the aptamer using site-directed mutagenesis. We also want to identify the nucleotides of the RNA aptamer that specifically bind BAFF-R using RNase protection assays. Understanding the specific interactions between BAFF-R and its aptamer would allow us to increase specificity, reducing off-target effects, and facilitate this therapeutic approach through clinical trials.

SSU Supervised Research Students: Celia Halsted, Cassidy Coleman, Cesar Galvan, Katy Valero, Alejandra Maldonado

Cell Specific Delivery of Therapeutic siRNA Using Aptamers, City of Hope, Dr. Rossi, **2010-2013**

RNA Aptamers have been identified to deliver siRNA specifically to HIV infected cell or cancerous cells. Better understanding of their three dimensional structure would aid in developing high quality therapeutic reagents. Molecular biology techniques utilized: synthesized and purified plasmid DNA, synthesized and purified RNA (47, 118, and 240 bases), synthesized and purified protein, *in-vitro* T7 transcription, cloning/bacteria transformation, agarose and acrylamide gel electrophoresis, site-directed mutagenesis, PCR, large-scale (> 1L) plasmid preparations, and screened macromolecules for crystallization conditions. I was responsible for project development and management.

A Novel RNA Gene: Human Accelerated Region 1 (HAR1), UC Santa Cruz, Dr. Scott, **2004-2009**

Developed an X-ray crystallography project stemming from the work done in Dr. Haussler's lab to

work towards determining the function of a novel RNA gene in collaboration with three UC labs. Molecular biology techniques (as above). Determined the structure of a macromolecule: screened macromolecules for crystallization conditions, handled and manipulated macromolecular crystals, data processing (MOSFLM, PHENIX, PHASER, COOT and CCP4 supported programs), Collected diffraction data at Stanford Synchrotron Radiation Laboratory (SSRL),

Advanced Light Source (ALS) at Lawrence Berkeley Lab, and with in-house machine; Chemical probing of RNA structure; RNA sequencing with reverse transcriptase**.** Development and managed project and I was the laboratory safety representative.

Hammerhead Ribozyme Kinetic Study, UC Santa Cruz, Dr. Scott, **2008**

Studied the effect of a base mutation on the rate of hammerhead (ribozyme) cleavageat various pHs.

Nitrophorins, Santa Clara Univ., Dr. Shachter, **2001-2003**

Synthesized, purified, and characterized nitrophorins for possible utilization as nitric oxide delivery.

PEER-REVIEWED PUBLICATIONS

Lares, M.; Rossi, J.J.; Ouellet, D.L. "RNAi and small interfering RNAs in human disease therapeutic applications." *Trends in Biotechnology.* **2010**, 28(100): *570-579.*

Young-In, C.; Martick, M.; Lares, M.; Kim, R.; Scott, W.G.; Kim, S.H. "Capturing Hammerhead Ribozyme Structures in Action by Modulating General Base Catalysis." *Public Library of Science: Biology* [Online] **2008,** 6(9): e234.

MANUSCRIPTS IN PREPARATION

Lares, M.; Scott, W. G. "Dimerized Structure gives further insight into the function of the novel RNA gene: HAR1." *in process*, **2009**

PRESENTATIONS

City of Hope Structure Club **2013**

Oral presentation, "*Prostate-Specific Membrane Antigen"*

City of Hope Structure Club **2012**

Oral presentation, "*Structural Insights into the Function of TAR RNA Binding PRotein"*

City of Hope RNA Journal Club **2010**

Oral presentation, "*Structure of Arabidopsis HYL1 and Its Molecular Implication*

for miRNA Processing."

San Jose City College **2009**

Oral presentaion, "*Insights into the function of a novel RNA gene: HAR1*"

ACS Annual National Conference **2008**

Poster presentation, *"Towards the structure and function of a novel RNA gene"*

ACS Annual National Conference **2006**

Poster presentation, *"Towards the structure and function of a novel RNA gene"*

SACNAS Annual National Conference **2005**

Oral presentation, *"Determining the structure and function of the rerty transcript"*

UC Santa Cruz Chemistry Department Seminar **2005**

Oral presentation, *"Catching Cu-nitrosyl enzymatic intermediates in nitrite reductase"*

SACNAS Annual National Conference **2002**

Poster presentation, *"Synthesis, Purification, and Characterization of Nitrophorins"*

GRANTS

Faculty Mentor- SSU student stipends in the amount of $550 to support undergraduate Research **2014**

Green Music Center Board of Advisors Committee Grant, "*The Chemistry of Wines and Winemaking*"**2014**

PROFESSIONAL TRAINING

Teaching is not Learning; workshop to train college-level science instructors about actively engaging students, emphasis on understanding that students don't learn until they have interacted with material, and teacher's success should not be based on how many topics are covered, but rather what students can do once the course has ended; **2012**

CLC Bio's Genomics Tools; hands-on workshop covered topics needed to effectively use the CLC bio Main Workbench for sequence analysis tools; **2012**

General Employee Radiological Training (GERT); educated in radiological terminology, hazards and risks, controls and identification systems, and employee responsibilities; **2008**

Rigaku Americas Corporation's Macromolecular Crystallography Training; trained in radiation safety, basic maintenance of R-Axis IV and R-Axis IV++, basic maintenance and alignment of confocal blue optics and cryo-cooling maintenance procedures, with introduction to data processing using d*Trek and Crystal Clear; **2007**

UNIVERSITY COMMUNITY INVOLVEMENT

Member of the Faculty Writing Program, Sonoma State University **2014**

Member of Women in Science and Engineering (WISE) **2006-**

Secretary for SACNAS at UC-Santa Cruz **2004-2005**

organized lecture by Dr. Rochin, executive director of SACNAS

hosted a workshop on succeeding in graduate school at national conference

organized Graduate and Medical Student Forum

participated in the Native American Health Disparities Forum

SERVICE

DEPARTMENT COMMITTEES AND SERVICE

Visiting Professor Search Committee	**2014**
Sea Wolf Day preparation and participation	**2014**
Freshman Summer Orientation Advisor	**2014**

SCHOOL COMMITTEES AND SERVICE

Radiation Safety Committee	**2014**

UNIVERSITY COMMITTEES AND SERVICE

Academic Freedom Subcommittee while Dr. Farmer is on sabattical	**2014 (Fall)**

COMMUNITY ACTIVITIES

LA County Science Fair Judge	**2012**
Latino Role Model Conference Presenter	**2004-2011**
Court Appointed Special Advocate for foster children in Santa Cruz County	**2006-2009**
Santa Cruz County Science Fair Judge	**2003-2008**

UNIVERSITY OUTREACH ACTIVITIES FOR SCIENCE

Presented to SURF and ACCESS students about graduate school	**2008**
Workshop Leader: "Mastering the Ph.D. process," focus on undergraduate population	**2007**
Presented to California State Univ. MB students about graduate school	**2007**
Mathematics, Engineering, Science Achievement (MESA) judge	**2006**
Panelist for UC Leads workshop	**2004**

MENTORSHIP ACTIVITIES IN SCIENCE PROGRAMS

Mentor to UC Leads undergraduate	**2007**
Supervise and train undergraduates in research protocols and laboratory techniques	**2004-**

Member of ChALE (Chican@s and Latin@s Educandose), mentor to incoming freshman **2004-2005**

ChUCK (a retention organization at UC Santa Cruz) tutor **2004-2005**

Appendix B

Learning Outcomes for specific chemistry courses

102:

Metric system, scientific notation, common units

Periodic table: elements, trends

Basic chemical reactions

Chemistry's applications to the environment: global warming, ozone depletion, ozone pollution, power production

Chemistry's applications to the home: soap, food, polymers

Basic laboratory techniques

Chem 105 – Learning Objectives

Atoms and molecules

1. Explain the structure of atoms (protons, electrons, neutrons).

2. Explain the make-up of the periodic table (atomic orbitals, electron occupancy, etc.)

3. Describe the fundamental properties of elements (ionization energies, electronegativity, size, etc.).

4. Define and explain the concept of a mole.

5. Based on the fundamental properties of elements, explain the formation of molecules (molecular orbitals, covalence, coordination).

Reactions

1. Define chemical equilibrium and write equilibrium expressions for reactions.

2. Describe acids and bases and the convention for quantifying these aspects of chemical reactivity (pKa).

3. Explain stoichiometry and write balanced equations.

Carbon Chemistry (Organic)

1. Describe the utilization of carbon as a fundamental biological building block in biology.

   a. Describe the valency of carbon

   b. Describe the position of carbon in the periodic table and the importance of this position.

   c. Explain hybridization and associated bonding

   d. Describe the diversity of shapes and sizes

   e. Explain chirality, enantiomers and diastereomers.

2. Describe bond formation of carbon with other elements.

   a. Describe the compounds with oxygen, nitrogen, hydrogen, etc.

   b. Describe the bonds to these elements.

   c. Explain what these heteroatoms do to the chemistry of the carbon-based molecule.

3. Based on the concepts described immediately above, explain nucleophilicity and electrophilicity (and the concept of a leaving group).

4. Describe the reaction of a nucleophile with an electrophile.

Amino acids and proteins

1. Draw the fundamental structure of an amino acid (note chirality).

2. Describe the chemical properties of the “R group” of all amino acids.

3. Describe and draw the fundamental linkage in a protein.

4. Explain the reactivity/properties of the amino acid linkage.

5. Explain the simple concepts associated with protein structure and the types of structures.

DNA

1. Describe the structure and function of DNA.

2. Explain the chemical reactivity of the components of DNA

    a. Phosphate backbone

    b. Ribose

    c. Bases

3. Describe the chemistries associated with DNA damage (based on the chemical reactivities described above).

Fatty acids, membranes

1. Define fatty acid

2. Describe the structure and function of membranes.

3. Describe fatty acid (especially arachidonic acid) metabolism.

Bioenergetics

1. Define ATP and its importance in bioenergetics.

2. Describe the structure of ATP and the importance of this structure (the phosphodiester bond) to bioenergetics.

3. Generally describe ATP biosynthesis.

4. Define respiration and the importance/chemistry of dioxygen.

Toxicology

1. Based on the concepts above, describe the toxicity of the following.

   a. Acids, bases.
   b. Lewis acids (heavy metals).
   c. Dioxygen
   d. Heavy metals
   e. Endocrine disruptors
   f. Electrophiles

Chemistry 107

Students will be proficient in chemistry and physics concepts covered by the California Subject Examination for Teachers (CSET).

Students will gain a foundation in chemistry and physics concepts that meet the K-8 California State Science Standards.

Students will demonstrate concept understanding by translating concepts in chemistry and physics into a level appropriate for K-8 students.

Students will gain experience in independently performing and developing hands on activities representative of the chemistry and physics concepts they are learning.

CHEM 110

1) To prepare students for 115a

2) Students should be able to do basic chemistry calculations. (Find molecular weights, calculate moles)

3) Students should understand basic chemistry concepts. (Particles, nuclear theory of the atom, Molarity)

4) Students should be able to perform basic laboratory functions (Measure out volumes using a graduated cylinder, weigh solids using a scale).

5) Students should gain experience in recording data in either a lab notebook or a worksheet.

CHEM 125A Honors analytical and General Chemistry

Students reinforce the basic concepts of atomic structure, dimensional analysis and chemical reactivity. Students learn to expand this knowledge to study the first law of thermodynamics, molecules in the gas state, Lewis model of bonding, intermolecular forces and molecules in the liquid state, chemical equilibrium, acids, basis and buffers. Students learn quantitative methods for data collection and learn to distinguish when to use a qualitative vs a quantitative approach to experimental execution.
Students learn about experimental design, how to record data, graph data and interpret graphical data, learn about error analysis and statistical analysis of data.
Students learn how to make standard solutions, serial dilutions and Beer's law.

CHEM 125B Honors analytical General Chemistry B

Students deepen their knowledge of general chemistry through an in-depth study of atomic theory and bonding of inorganic and organic molecules. Students learn about the kinectics of molecular interactions, the second law of thermodynamics, electrochemistry and selected topics.

Students learn advance quantitative methods for experimental execution including standard addition, redox titration and spectroscopy.
Students learn how to communicate their experimental data into a written report.
Students learn how to work in groups and read a basic literature article and execute an experiment from such an article.

255:

Quantitative laboratory techniques: analytical balance, volumetric flask, pipettes

Statistics: t-test, F-test, Q-test, Limit of detection / quantification

Propagation of error

Quantification: Calibration curve, Standard addition

Basics of scientific instruments: UV, GC, MS

CHEM 325 Inorganic Chemistry

Students learn about basic and advance models of bonding for inorganic and organic molecules. These models include the Lewis model, valance bond theory and molecular orbital theory. These bonding models are taught using group theory and symmetry to determine orbital overlap and interactions.
Students learn about absorption spectroscopy using molecular orbital model or atomic orbital model. The spectroscopy includes IR, UV-vis, Raman, and fluorescences. The course uses group theory and symmetry to discuss selection rules, transitions and ground and excited states.
Students learn about molecular reactivity of organic, inorganic and organo- metallic molecules. Mechanisms of substitution, electron transfer and ligand rearrangement are covered along with the kinetic analysis and thermodynamic stability
Students learn about coordination chemistry and the theory of d-orbital splitting and the effects of this on the color and magnetism of coordination molecules. Bonding and spectroscopy of coordination compounds are discussed. Applications of these models are studied as they apply to the current chemical literature and students learn how to read and analyzed an article from a high impact journal.

CHEM 335A Organic Chemistry First Semester

<u>Chemical Bonds</u>

1. Describe the principles behind drawing Lewis Structures.

2. Be able to draw appropriate Lewis structures, based on the principles described above.

3. Discuss the difference between ionic and covalent bonds.

4. Assign formal charges to atoms in chemical structures.

5. Describe and explain the shapes of molecules.

6. Explain the concept of resonance from a Lewis dot perspective.

7. Determine the polarity of bonds and molecules.

Organic Compounds

1. Recognize stable bonding ion organic molecules.

2. Define bond strengths and draw the process that defines this value.

3. Describe constitutional isomers and draw constitutional isomers from molecular formulas.

4. Describe the conventions used for drawing organic molecules.

5. Understand the concept of a functional group and be able to describe molecules on the basis of their functional groups.

Orbitals

1. Identify and draw atomic orbitals (s, p, d).

2. Describe the filling of orbitals with electrons.

3. Describe how atomic orbitals combine to make molecular orbitals.

4. Define bonding and anti-bonding interactions between bonding atoms.

5. Describe hydridization of atomic orbitals and explain why this occurs.

6. Explain sigma and pi bonding. Describe these bonds on the basis of the atomic orbitals that make them.

7. Define and draw resonance structures based on molecular orbitals.

8. Explain the energies of molecular orbitals.

<u>Acid-Base Chemistry</u>

1. Describe the Bronsted-Lowry and Lewis acids and bases and the factors associated with the acidity or basicity of molecules.

2. Define pK_a and explain its utility in explaining/understanding of organic reactions.

3. Properly assess the relative acidity and/or basicity of protons on molecules.

<u>Nomenclature</u>

1. Describe the conventions used to name organic molecules.

2. Name simple organic molecules.

Sterochemistry

1. Explain cis-trans isomers and assess their relative stabilities.

2. Define conformation and draw conformations using Newman projections.

3. Analyze and discuss the energetics of conformations in acyclic and cyclic molecules.

4. Draw the conformations of cyclohexanes and describe the energetics of the conformers.

5. Define 1-3 diaxial interactions in cyclohexanes.

6. Define chiral and identify chirality or chiral centers in molecules.

7. Describe optical activity.

7. Define configuration and enantiomers.

8. Explain the convention for assigning configuration.

9. Describe meso compounds

10. Draw enantiomers and assign configuration.

11. Identify and describe diastereomers.

12. Describe the seperation of enantiomers using the concept of diastereomers.

Nucleophilic Substitution Reactions

1. Generally describe a substitution reaction by identifying and describing the nucleophile, electrophile and leaving group.

2. Describe the factors contributing to nucleophilicity, electrophilicity and the propensity for a moiety to be a leaving group.

3. Describe the two mechanisms of a substitution reaction (S_N1 and S_N2).

4. Describe the stereochemical outcome of the S_N1 and S_N2 reactions.

5. Explain the competition between the substitution reactions.

6. Describe hyperconjugation.

7. Explain carbocation rearrangements and describe the stability of carbocations.

Elimination Reactions

1. Describe and draw out the E1 and E2 reactions.

2. Describe how these reactions compete with substitution chemistry.

3. Explain the regiochemistry of elimination reactions.

Organic Synthesis

1. Using the concepts associated with substitution and elimination chemistry, devise simple synthetic schemes for making alcohols, alkyl halides, ethers, etc.

Addition Reactions

1. Describe and draw the general mechanism of addition of an electrophile (HX, X_2, HgX_2, BH_3, carbenes, etc.) to a multiple bond (define reaction components).

2. Predict the regiochemistry and stereochemistry for the addition of an electrophile to a multiple bond.

3. Discuss possible rearrangements associated with addition reactions.

Lab

1. Describe the concept of recrystallization.

2. Describe and explain the concept of solubility and extraction (especially as it pertains to ionization state).

3. Describe chromatography in general and the concepts associated with the separation of organic molecules using TLC, GC and HPLC.

4. Describe simple, fractional and steam distillation and explain when to use them.

5. Describe nuclear magnetic resonance and it use in organic chemistry (this is much to big and is broken down below).

    a. Explain chemical shift.

    b. Explain coupling.

c. Describe an NMR spectrum and its utility in determining chemical structure.

d. Interpret simple NMR spectra

e. Draw the NMR spectrum for simple organic molecules.

6. Describe IR spectroscopy and it's utility in characterizing organic molecules.

7. Devise a separation scheme for mixtures of acidic, basic and neutral species.

CHEM 335B Organic Chemistry Second Semester

Functonal Groups

1. Draw the generic structures for aromatics (benzene derivatives) and all the c arbonyl-based species (ketones, aldehydes, esters, etc.).

2. Explain nomenclature of the above.

Aromaticity and aromatic compounds

1. Using molecular orbital theory, explain the special stability associated with aromatic compounds.

2. Using molecular orbital theory, explain the lack of stability stability associated with anti-aromatic compounds.

3. Explain the 4N + 2 rule for aromaticity.

Aromatic Substitution Reactions

1. Describe and draw the mechanism of an electrophilic aromatic substitution reaction.

2. Describe the electronic effects associated with an electrophilic aromatic substitution reaction and how these determine the position of substitution.

3. Describe and draw the mechanism of a nucleophilic aromatic substitution reaction.

4. Explain the electronic effects associated with the nucleophilic aromatic substitution reaction.

5. Devise syntheses for simple substituted aromatic compounds using the concepts above for both nucleophilic and electrophilic reactions.

Carbonyl group chemistry – aldehydes and ketones

1. Explain the reaction mechanism of aldehydes and ketones with nucleophiles.

2. Predict the products of the reactions of nucleophiles with aldehydes and ketones (Wittig, Schiffs base, hydride, Grignard, acetals, ketals, etc.)

3. Explain and draw the attack of a nucleophile on a conjugated carbonyl compound.

Carbonyl group chemistry – carboxylic acids and derivatives

1. Describe the chemical properties of carboxylic acid derivatives (electrophilic center, leaving group, etc)

1. Describe the general mechanism of substitution reactions on carboxylic acid derivatives (acids, esters, etc.).

2. Explain, in general terms, the relative reactivities (and reactions) of acid chlorides, anhydrides, aldehydes, ketones, esters, amides and acids.

3. Describe methods for the conversion of one carboxylic acid derivative to another (i.e. conversion of an acid to an acid chloride).

Enolates

1. Explain the acidity of hydrogens alpha to a carbonyl.

2. Explain the relative pKa values for alpha hydrogens.

3. Explain the reaction of an enolate with an electrophile.

4. Draw and explain the mechanism of an aldol condensation (and related reactions).

5. Define a 1,4- or Michael addition and draw the mechanism and products of a Robinson annulation.

Radicals

1. Define “radical”.

2. Describe the relative stabilities of carbon-centered radicals and explain.

3. Describe the reactivity of radicals.

4. Describe and explain the chain character of a radical halogenation reaction.

5. Describe methods for the generation of radicals and their use in organic synthesis.

6. Explain “anti-oxidants” (as it pertains to biological radical processes).

Pericyclic Reactions

1. Define pericyclic.

2. Define HOMO and LUMO.

3. Explain pericyclic reactions using MO theory (describe the "flow" of electrons).

4. Explain "allowed" and "forbidden" reactions.

5. Describe conrotatory and disrotatory and indicate when these processes occur.

6. Describe and draw a Diels-Alder reaction.

7. Define and draw a sigmatropic rearrangement (e.g. a Cope).

Synthesis

1. Explain the use of protecting groups in synthesis.

2. Describe protecting groups for alcohols, aldehydes, ketones and explain why they are needed.

3. Explain retrosynthesis and utilize it to design a synthetic scheme for a simple molecule.

CHEM 336 A/B

1) Student should be able to use chemistry instrumentation. (IR, NMR, MP)

2) Student should be able to write a coherent lab report including an analysis of collected data.

3) Students should be able to keep a detailed notebook.

4) Students should be able to perform important organic chemistry techniques. (Distillation, recrystallization, extraction)

5) Students should have a detailed knowledge of NMR theory.

401:

Electronics (ohm's law, op-amps)

Instrumental operation: UV, fluorimeter, NMR, GC, HPLC, MS

Ability to do independent research:

- Literature search
- Scientific method (design a hypothesis and test it)
- Work independently on a project based in the literature

CHEM 402

Proficient in searching, understanding, and utilizing the scientific literature.

Learn standard techniques and instrumentation for the characterization of organic and inorganic molecules

Learn both general and air sensitive techniques for making organic and inorganic molecules

Students will be able to design and troubleshoot chemical experiments to test a hypothesis.

Students will effectively communicate their research plans and results through oral, written, and poster presentation formats.

Students will work effectively in a group to facilitate scientific progress on their own project as well as the projects of their peers.

Chemistry 441

Students will become proficient in searching, understanding, and utilizing the scientific literature.

Students will become proficient in the use of standard techniques and instrumentation for the characterization of proteins and enzymes including buffer preparation, chromatography, protein and activity assays, gel electrophoresis, and spectroscopy.

Students will be able to design and troubleshoot biochemical experiments to test a hypothesis.

Students will effectively communicate their research plans and results through oral, written, and poster presentation formats.

Students will work effectively in a group to facilitate scientific progress on their own project as well as the projects of their peers.

Chemistry 445

Students will be able to identify and describe, using proper chemical terminology, the structural features of different classes of biological macromolecules and how the physical and chemical properties of those structures gives rise to physiological function.

Students will be able to describe the role of thermodynamics in the structure and function of biological macromolecules.

Students will be able to qualitatively and quantitatively describe the important aspects of protein function including the structural and functional characteristics of protein-ligand interactions and the key features of enzyme catalysis including chemical mechanisms, kinetics, regulation, and inhibition.

Students will be able to qualitatively and quantitatively describe concepts and techniques involved in protein isolation and characterization including buffer preparation, protein purification methodologies, and determination of macromolecule composition.

Students will gain general skills important for scientific progress including teamwork, scientific communication, and reading the scientific literature.

Chemistry 446

Students will be able to characterize and describe chemical reaction types commonly found in metabolic pathways.

Students will be able to describe regulation methods, key regulation points, and the manner in which different metabolic pathways are integrated and regulated together.

Students will be able to describe and quantify the bioenergetics of common metabolic reactions and pathways.

Students will be able to describe and separate the thermodynamic and kinetic aspects of metabolic reactions.

Students will be able to identify key molecules in metabolic pathways and describe the chemical basis for their biological function.

Students will gain general skills important for scientific progress including teamwork, scientific communication, and reading the scientific literature.

CHEM 494 Undergraduate Research

Students learn how to read the chemical literature and apply what science has been done to a project that they develop under the mentorship of a faculty member
Students learn how to collect and record data
Students learn how to design and execute and experiment to answer a specific scientific question
Students will learn how to communicate their scientific findings through written, oral and poster format
Students will learn how to independently work in a research enviroment
Students will learn how to safely work with chemicals, instruments and others.

Appendix C

Sample 4-Year Plans

Bachelor of Science in Chemistry (certified by the American Chemical Society)

The B.S. degree provides thorough preparation for students who wish to pursue advanced degrees in the chemical sciences, go to professional school, or work as chemists in industry. All courses in the major core, major electives, and supporting courses must be taken in the traditional grading mode (A-F). Transcripts will be noted as approved by the American Chemical Society.

Please see the current approved curriculum on the SSU official catalog web page.

Major Core Requirements	**Units**	**Completed**	**To do (Semester)**
CHEM 125AB*, Quantitative General Chemistry…………..............…………4	☐	________	
(10 units, 4 in the major core, 6 in general education (GE B1 & B3)			
CHEM 255, Quantitative Analysis*.……………………………………….4	☐	________	
CHEM 275, Instrumental Analysis …………………………………….....2	☐	________	
CHEM 310AB, Physical Chemistry…………………………………….......6	☐	________	
CHEM 315 & 316, Intro to Research Methods …………...…………..3	☐	________	
CHEM 325, Inorganic Chemistry……………………………………….......3	☐	________	
CHEM 335AB, Organic Chemistry Lecture….................................6	☐	________	
CHEM 336AB, Organic Chemistry Laboratory……….. …….............4	☐	________	
CHEM 401, Senior Integrated Lab ………………...…………………......3	☐	________	
CHEM 402, Advanced Synthesis and Analysis ……….....…………….3	☐	________	
CHEM 445, 446, or 340, Biochemistry……………………………..…….3	☐	________	
CHEM 497, Research Seminar……………………………………………. 1	☐	________	
CHEM 496, Chemistry Elective……………………………………………6			
Total units in the major core 48			

Supporting Courses

MATH 161, Calculus I (3 units, counted as GE B4)……………………..1	☐	________	

MATH 211, Calculus II……………………………………………………………..…4 ☐ ________

MATH 261, Calculus (IV)…………………………………………………….……4 ☐ ________

PHYS 114, Introduction to Physics I…………………………………………....4 ☐ ________

PHYS 116, Introduction to Physics Laboratory I……….………………….1 ☐ ________

PHYS 214, Introduction to Physics II………………………………… ….4 ☐ ________

PHYS 216, Introduction to Physics Laboratory II…………………………. 1 ☐ ________

Total units in supporting courses 19

GE Courses

CHEM 120AB, Thinking Like a Scientist, (GE A3)……………………..…….4

CHEM 115AB, (GE B1 & B3)……………………………….……………….…..…6

MATH 161, (GE B4)………………………………………………………….……...3

Others………………………………………………………………………….……………..37

Total units in GE courses 50

Electives……………………………………………………………………. 3

Total units to graduate………………………………………………**120**

Sample Four-year Program for B.S. in Chemistry

Freshman Year:

Fall semester (14 units)	*Spring semester (16 units)*
CHEM 125A (5)	CHEM 125B (5)
CHEM 120A (2)	CHEM 120B (2)
MATH 161 (4)	PHYS 114 (4)
GE (3)	PHYS 116 (1)

	MATH 211 (4)

Sophomore Year:

Fall semester (14 units)	*Spring semester (18 units)*
CHEM 335A (3)	CHEM 335B (3)
CHEM 336A (2)	CHEM 336B (2)
MATH 261 (4)	**CHEM 255 (4) * See Below**
PHYS 214 (4)	GE (3)
PHYS 216 (1)	GE (3)
	Elective (3)

Junior Year:

Fall semester *(15 units)*	*Spring semester (15 units)*
CHEM 445 (3)	CHEM 310B (3)
CHEM 310A (3)	CHEM 316 (2)
CHEM 315 (1)	CHEM Elective (3)
GE (4)	GE (4)
GE (4)	GE (3)

Senior Year:

Fall semester (15 units)	*Spring semester (13 units)*
CHEM 401 (3)	CHEM 402 (3)
CHEM Elective (3)	CHEM 497 (1)
CHEM 275 (2)	CHEM 325 (3)

GE (4)	GE (3)
GE (3)	GE (3)

Total semester units: 120

* **Quantitative Analysis (CHEM 255) is not required for students who have completed CHEM 125 A & B. Students should replace these four units by completing the challenge by exam form upon completion of the series.**

Bachelor of Science in Biochemistry

All courses in the major core, major electives and supporting courses must be taken in the traditional grading mode (A-F). Undergraduate research is required for the B.S. degree in biochemistry.

Major Core Requirements	Units	Completed	To Do (Semester)
CHEM 125 AB*, General Chemistry	4	☐	________
(10 units, 4 in the major core, 6 in general education B1 & B3)			
CHEM 255, Quantitative Analysis*	4	☐	________
CHEM 275, Instrumental Analysis	2	☐	________
CHEM 310 AB, Physical Chemistry	6	☐	________
CHEM 315 & 316, Intro. To Research Methods	3	☐	________
CHEM 325, Inorganic Chemistry	3	☐	________
CHEM 335 AB, Organic Chemistry Lecture	6	☐	________
CHEM 336 A, Organic Chemistry Lab	2	☐	________
CHEM 401, Instrumental Analysis and Chemical Synthesis	3	☐	________
CHEM 441, Biochemical Methods	3	☐	________
CHEM 445, Structural Biochemistry	3	☐	________
CHEM 446, Metabolic Biochemistry	3	☐	________
CHEM 497, Research Seminar	1	☐	________
Total units in major core	**43**		

Biology Courses	Units	Completed	To Do (Semester)
BIOL 123, Molecular and Cell Biology	1	☐	________
(4 units, 1 in the major core, 3 in general education B2)			
Choose **2** from the following:			________
UD CHEM Elective	3	☐	________
BIOL 320, Molecular Genetics	4	☐	________

BIOL 321, Molecular Microbiology	4	☐	______
BIOL 324, Animal Physiology	4	☐	______
BIOL 325, Cell Biology	4	☐	______
BIOL 334, Plant Physiology	4	☐	______
BIOL 340, General Bacteriology	4	☐	______
BIOL 382, Parasitology	4	☐	______
BIOL 383, Virology	4	☐	______
BIOL 480, Immunology	4	☐	______
BIOL 544, Advanced Cell Biology	4	☐	______
Or other courses approved by the Chemistry Department			
Total units in Biology Courses	**7-9**		

Supporting Courses

MATH 161, Calculus I (4 units, 1 in the major core, 3 in GE B4)	1	☐	
MATH 211, Calculus II	4	☐	______
PHYS 114 or 210A, Physics I	3-4	☐	______
PHYS 116 or 209A, Physics Laboratory I	1	☐	______
PHYS 214 or 210B, Physics II	3-4	☐	______
PHYS 216 or 209B, Physics Laboratory II	1	☐	______
Total units in Supporting Courses	**13-15**		

GE Courses

CHEM 120AB, Thinking Like a Scientist, (GE A3)……………………..…….4

CHEM 115AB, (GE B1 & B3)………………..……………………………………6

MATH 161, (GE B4)……………………………………………………………...3

Bio 123, (GE B2)…………………………………………………………………3

Others…………………………………………………………………………………….34

Total units in GE courses 50

Electives………………………………………………………………………………. 3 - 7

Total units to graduate……………………………………………………………**120**

Freshman Year:

Fall semester (14 units)	*Spring semester (14 - 15 units)*
CHEM 125A (5)	CHEM 125B (5)
CHEM 120A (2)	CHEM 120B (2)
MATH 161 (4)	PHYS 210A (3) or PHYS 114 (4)
GE (3)	PHYS 209A (1) or PHYS 116 (1)
	MATH 211 (4)

Sophomore Year:

Fall semester (15-16 units)	*Spring semester (17 units)*
CHEM 335A (3)	CHEM 335B (3)
CHEM 336A (2)	**CHEM 255 (4) * See Below**
PHYS 210B (3) or PHYS 214 (4)	GE (4)
PHYS 209B (1) or PHYS 216 (1)	GE (3)
GE (3)	GE (3)
Elective (3) Recommended: MATH 261 (4)	

Junior Year:

Fall semester (14-16 units)	*Spring semester (12-14 units)*

CHEM 310A (3)	CHEM 310B (3)
CHEM 315 (1)	CHEM 316 (2)
CHEM 445 (3)	CHEM 446 (3)
BIOL 123 (4)	GE (4)
GE (3)	Elective (0 to 2)
Elective (0 to 2)	

Senior Year:

Fall semester (15-16 units)	*Spring semester (14-15 units)*
CHEM 275 (2)	CHEM 497 (1)
CHEM 401 (3)	CHEM 325 (3)
BIOL or CHEM elective Upper division (3-4)	CHEM 441 (3)
GE (4)	BIOL or CHEM elective Upper division (3-4)
GE (3)	GE (4)

*** Quantitative Analysis (CHEM 255) is not required for students who have completed CHEM 125 A & B. Students should replace these four units by completing the challenge by exam form upon completion of the series.**

Bachelor of Arts in Chemistry

The B.A. degree provides a solid foundation in chemistry so students have the same career options as those with the B.S. degree, while allowing students the flexibility to pursue other academic interests. All courses in the major core, major electives, and supporting courses must be taken in the traditional grading mode (A-F). It is highly recommended that students perform undergraduate research with a faculty member. Please see the current approved curriculum on the SSU official catalog web page.

Major Core Requirements		Units	Completed	To do (Semester)
CHEM 125AB*, Quantitative General Chemistry…………..……………4		☐	________	
(10 units, 4 in the major core, 6 in general education (GE B1 & B3)				
CHEM 255, Quantitative Analysis*……………………………………….4		☐	________	
CHEM 275, Instrumental Analysis ……………………………………......2		☐	________	
CHEM 310AB, Physical Chemistry……………………………………......6		☐	________	
CHEM 325, Inorganic Chemistry……………………………………….......3		☐	________	
CHEM 335AB Organic Chemistry…………………………………….........6		☐	________	
CHEM 336A, Organic Chemistry Laboratory……….. ………………......2		☐	________	
CHEM 401, Senior Integrated Lab …………………..…………………......3		☐	________	
CHEM 497, Research Seminar……………………………………….. …..1		☐	________	
CHEM 496, Chemistry Elective..………………………………………….3		☐	________	
Total units in the major core	**34**			

Supporting Courses			
MATH 161, Calculus I …………………………………………………1	☐	________	
(4 units, 1 in the major core, 3 in general education (GE B4)			
MATH 211, Calculus II……………………………………………......4	☐	________	
PHYS 114 or 210A Physics I……………………………………………3-4	☐	________	
PHYS 116 or 209A Physics Laboratory I…………………………………..1	☐	________	
PHYS 214 or 210B Physics II……………………………………………..3-4	☐	________	
PHYS 216 or 209B Physics Laboratory II………………………………. 1	☐	________	

Total units in supporting courses **13-15**

GE Courses

CHEM 120AB, Thinking Like a Scientist, (GE A3)………………………..…….4

CHEM 115AB……………….……………………………………….. …………6

MATH 161………………………………………………………………...3

Others……………………………………………………………………..37

Total units in GE courses **50**

Electives………………………………………………………….……. 21-23

Note! To meet the campus' requirement of 40 upper division units

at least 7 units of these electives need to be in upper division courses.

Please discuss this with your advisor.

Total units to graduate……………………………………………….**120**

Freshman Year:

Fall semester (14 units)	*Spring semester (15 or 16 units)*
CHEM 125A (5)	CHEM 125B (5)
CHEM 120A (2)	CHEM 120B (2)
MATH 161 (4)	PHYS 210A (3) or PHYS 114 (4)
GE (3)	PHYS 209A (1) or PHYS 116 (1)
	MATH 211 (4)

Sophomore Year:

Fall semester (14 or 15 units)	*Spring semester (18 units)*
CHEM 335A (3)	CHEM 335B (3)

CHEM 336A (2)	CHEM 336 (2) (Elective units)
PHYS 210B (3) or PHYS 214 (4)	**CHEM 255 (4) *See Below**
PHYS 209B (1) or PHYS 216 (1)	GE (3)
GE (3)	GE (3)
Elective (1 or 3) Recommended: MATH 261 (4)	Elective (3)

Junior Year:

Fall semester (16 units)	*Spring semester (14 units)*
CHEM 310A (3)	CHEM 310B (3)
GE (4)	GE (4)
GE (3)	GE (4)
GE (3)	GE (3)
Elective (3)	

Senior Year:

Fall semester (15 units)	*Spring semester (13 units)*
CHEM 401 (3)	CHEM 497 (1)
CHEM 275 (2)	CHEM 325 (3)
GE (4)	Elective (3)
Chemistry Elective (3)	Elective (3)
Elective (3)	Elective (3)

Total semester units: 120

Chemistry Electives: CHEM 336, 445, 446, 315, 316, 402, 441, or UD CHEM Elective

*** Quantitative Analysis (CHEM 255) is not required for students who have completed CHEM 125 A & B. Students should replace these four units by completing the challenge by exam form upon completion of the series 125.**

Appendix D

Chemistry Department Course Offerings

CHEM 102 Chemistry and Society (3)

Lecture, 2 hours; laboratory, 3 hours. An introductory course in chemistry for non-majors. Covers the basics of chemistry related to everyday life. The laboratory will consist of experiments covering chemical principles and phenomena discussed in the lecture. Satisfies GE Area B1 (Physical Sciences) and the GE laboratory requirement.

CHEM 102 Chemistry and Society (3)

Lecture, 2 hours; laboratory, 3 hours. An introductory course in chemistry for non-majors. Covers the basics of chemistry related to everyday life. The laboratory will consist of experiments covering chemical principles and phenomena discussed in the lecture. Satisfies GE Area B1 (Physical Sciences) and the GE laboratory requirement.

CHEM 105 Elements of General, Organic, and Biochemistry (5)

Lecture, 4 hours; laboratory, 3 hours. A survey of the principles of chemistry, with emphasis placed on those that apply to living organisms. The course is designed for students in Nursing and majors that do not require further courses in Chemistry. Course is not a prerequisite for any chemistry course. Satisfies GE Area B1 (Physical Sciences) and the GE laboratory requirement.

CHEM 105 Elements of General, Organic, and Biochemistry (5)

Lecture, 4 hours; laboratory, 3 hours. A survey of the principles of chemistry, with emphasis placed on those that apply to living organisms. The course is designed for students in Nursing and majors that do not require further courses in Chemistry. Course is not a prerequisite for any chemistry course. Satisfies GE Area B1 (Physical Sciences) and the GE laboratory requirement.

CHEM 107 Introduction to Physical Science for Teachers (3)

Lecture, 3 hours. A non-mathematical course designed to introduce students to a range of topics in physics and chemistry that are required by the California Science Standards for grades K-8, including the laws of motion, energy, the structure of matter, the states of matter, electricity and magnetism, and light and optics. Lectures include many demonstrations to illustrate physical science principles and students will be asked to think about how they would demonstrate or explain various concepts.

CHEM 110 Introductory General Chemistry (3)

Lecture, 3 hours. Develop fundamental knowledge and necessary skills in General Chemistry for students who plan to major in science or pre-health programs. Recommended for students

with no prior chemistry background or as a refresher course to enhance an insufficient chemistry background. Topics covered include the scientific method, word problem analysis, significant figures, scientific notation, unit conversion, periodic table, chemical equations, fundamental laws of matter and energy, the mole concept and stoichiometry. Satisfies GE Area B1. Fall only.

CHEM 115A General Chemistry (5)

Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Principles of chemistry for students in science, pre-health, and related areas of study. This course will introduce students to science and scientific thought by using problem-solving strategies in both a conceptual and mathematical manner. First semester topics include atomic

and molecular structure, states of matter, chemical reactions, stoichiometry, and thermodynamics. Second semester topics include kinetics, equilibrium, buffers, and electrochemistry. Prerequisite:

GE math placement. Satisfies GE Area B1 (Physical Sciences), and laboratory requirements.

CHEM 115B General Chemistry (5)

Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Continuation of CHEM 115A. Prerequisite: CHEM 115A. Satisfies GE Area B1 (Physical Sciences), and laboratory requirements.

CHEM 125A Quantitative General Chemistry (5)

Lecture, 3 hours; discussion 1 hour; laboratory 3 hours (5 units). This one-year analytical general chemistry course is designed for Chemistry majors, Biochemistry majors, or others interested in chemical fields who have taken High School Chemistry or equivalent. This first semester course (CHEM 125A) will focus on: statistics, atomic structure, stoichiometry, gas laws, redox reactions, equilibrium, and acid/base reactions. Prerequisites: high school chemistry or equivalent and GE math placement.

CHEM 125B Quantitative General Chemistry (5)

Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours (5 units). The second semester (CHEM 125B) starts by applying the topics covered in the first semester to chemical literature, chromatography, spectroscopy, biological chemistry, thermodynamics, electrochemistry, quantum mechanics, bonding, and kinetics. After completion of this course students will receive credit for the full

year of general chemistry and one semester of quantitative analysis

(CHEM 255). Prerequisite: CHEM 125A.

CHEM 255 Quantitative Analysis (4)

Lecture, 2 hours; laboratory, 6 hours. Theory and practice of methods of analysis, including volumetric, gravimetric, and selected instrumental techniques. Prerequisite: CHEM 115B.

CHEM 275 Instrumental Analysis (2)

This course focuses on the theory behind commonly used chemistry instruments. Lecture will focus on analysis of spectroscopic data (molecular transitions), an overview of instrumental hardware, and principles of chromatography. Topics include basic electronics, statistics, optics, signal to noise detectors, IR, optical, NMR and fluorescence spectroscopy, mass spectrometry, atomic absorption, and chromatography. Prerequisite: CHEM 335B.

CHEM 310A Fundamentals of Physical Chemistry (3)

Lecture, 3 hours. Development and applications of the concepts of thermodynamics, equilibrium, kinetics, quantum mechanics, and spectroscopy to chemical systems. Prerequisites: CHEM 115B or CHEM 125B; MATH 211.

CHEM 310B Fundamentals of Physical Chemistry (3)

Lecture, 3 hours. Continuation of CHEM 310A. Prerequisite: CHEM

310A required; or consent of instructor.

CHEM 315 Introduction to Research Methods in Chemistry (1)

Chemistry 315 is designed for Chemistry majors but may be taken by others. Students will learn about research in Chemistry at SSU and then will choose a research project with a faculty mentor. This

course will focus on preparation of a proposal to be performed in the subsequent semester. Topics such as scientific ethics, literature, and writing will also be covered.

CHEM 316 Research Methods in Chemistry (2)

Chemistry 316 is the second part of a year-long course designed for Chemistry majors. Students will execute the research proposal developed in CHEM 315. Research will be done under the mentorship of faculty. Students will meet weekly to discuss research progress. Students will conclude the semester with a research manuscript.

CHEM 325 Inorganic Chemistry (3)

Lecture, 3 hours; Atomic structure, symmetry, and group theory of small molecules and the relationship of these concepts to bonding theory and molecular spectroscopy. Applications of symmetry and group theory to coordination chemistry of transition metal complexes in organometallic, environmental, bioinorganic, and materials chemistry. Other topics include kinetics and reaction mechanisms of inorganic and organometallic compounds including electron transfer. Prerequisite: CHEM 310B, or concurrent enrollment.

CHEM 335A Organic Chemistry (3)

Lecture, 3 hours. A study of the fundamental principles of organic chemistry including bonding, electrophilicity, nucleophilicity, and molecular shapes and geometry for organic compounds. Applies these concepts to the study of the properties, syntheses, and reactions of major classes of organic compounds. A special

emphasis is given to reaction mechanisms. Prerequisite: CHEM 115B

or CHEM 125A (with department consent), or consent of instructor.

CHeM 335B OrgAniC CHeMiStry (3)

Lecture, 3 hours. Continuation of CHEM 335A. Prerequisite: CHEM 335A.

CHeM 336A OrgAniC CHeMiStry LAB i (2)

Laboratory lecture, 1 hour; laboratory, 3 hours. Fundamental techniques in organic chemistry, emphasizing separation techniques, modern instrumental methods, and qualitative organic analysis. Designed to complement CHEM 335A. Prerequisite/co-requisite: CHEM 335A.

CHeM 336B OrgAniC CHeMiStry LAB ii (2)

Laboratory lecture, 1 hour; laboratory, 3 hours. Fundamental techniques of organic chemistry, emphasizing synthetic organic chemistry, modern instrumental methods, and qualitative organic analysis. Designed to complement CHEM 335B. Prerequisite/co- requisite: CHEM 335B.

CHeM 397 CHeMiStry prACtiCuM (1-6)

Supervised chemistry work experiences that involve practical application of previously studied theory. Intended for professional growth and/or collection of data for future theoretical interpretation. Not applicable toward the Chemistry major or minor. May be repeated for up to a total of 6 units. Two hours of work per week for each unit of credit. Cr/NC only. Prerequisite: consent of instructor

CHeM 401 Senior integrAted LAB (3)

Fall only. This course focuses on making connections between the sub-disciplines of chemistry by performing experiments that cross over between these sub-disciplines in this capstone course. Students will perform experiments independently. Students will learn to

properly write up their results in a format similar to published papers. This course is for graduating seniors and is the capstone for B.A. Chemistry majors. Prerequisite: CHEM 255.

CHeM 402 AdVAnCed SyntHeSiS And inStruMentAL AnALySiS (3)

Lecture, 1 hour; laboratory, 6 hours. Project-based synthesis, purification, and characterization of inorganic, organic, and organometallic molecules. Capstone course for the B.S. chemistry degree. Topics will include air-sensitive syntheses, standard Schlenk line techniques, characterization through IR, optical and NMR spectroscopy, mass spectrometry, and electrochemistry. This

course is for graduating seniors and is the capstone for BS Chemistry majors. Prerequisite: CHEM 401. Highly recommended: CHEM 325

co-requisite, or consent of instructor.

CHeM 441 BioCHeMiCAL MetHodS (3)

Project based course involving characterization of proteins from natural sources utilizing biochemical methods and experimental design techniques common in biotechnology and research. This course is for graduating seniors and is the capstone for B.S. Biochemistry majors. Offered in spring only. Prerequisites: CHEM

445 or 446 (may be concurrent), CHEM 255, and a foundation in spectroscopy; kinetics strongly recommended.

CHeM 445 StruCturAL BioCHeMiStry (3)

Lecture, 3 hours. A study of the structure-function relationships of amino acids, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Also includes topics such as enzyme kinetics, membrane transport, and signaling. Only offered in the fall. Prerequisites: CHEM 335B or CHEM 232, and a foundation in kinetics and thermodynamics, or consent of instructor.

CHeM 446 MetABoLiC BioCHeMiStry (3)

Lecture, 3 hours. A study of bioenergetics and the metabolism of biological molecules including carbohydrates, lipids, nucleic acids, and proteins. This course is only offered in the spring. Prerequisites: CHEM 335B or CHEM 232, CHEM 445 or BIOL 123, and a foundation in kinetics and thermodynamics, or consent of instructor.

CHEM 492 Chemistry Seminar Series (1)

Invited speakers from universities and industry will present on current topics in the chemical and biochemical fields. May be repeated;

does not count towards the major.

CHEM 494 Undergraduate Research (1-6)

Under supervision by the Chemistry faculty, students will participate in individual investigations of student- or faculty-initiated chemical problems. May be taken only by petition to the Chemistry Department. May be repeated. Prerequisite: consent of instructor.

CHEM 495 Special Studies (1-3)

Investigation of existing information on a specific or general topic of interest to the student. Prerequisites: consent of instructor; upper- division standing in chemistry or closely related science.

CHEM 496 Selected Topics in Chemistry (1-6)

A study of an advanced topic in chemistry. May be repeated for credit with new subject matter.

CHEM 497 Research Seminar (1)

Laboratory, 3 hours. Capstone course for B.A. and B.S. degrees. The course will focus on techniques involved in the preparation and delivery of technical seminars. This final project will be a formal oral presentation to the Chemistry department on a research paper from the chemical literature or the student’s undergraduate research project. Instruction includes the appropriate coverage of the selected topic, use of the chemical literature, and the reparation and use

of PowerPoint, graphic, and web-based applications to create an informative talk. Prerequisite: CHEM 401 required, or consent of instructor.

CHEM 499 Internship (1-4)

Chemistry field experience in industrial, hospital, or similar laboratory settings. Enrollment by prior arrangement with supervising faculty member and community sponsor. Please see department advisor

for details. Three hours of work per week for each unit of credit. Internship assignments may be paid. Cr/NC only. May be repeated.

Appendix E

Exit Exam

Name:______________________________

SSU Department of Chemistry Exit Exam
March 2011

1. Find the pH of a mixture of 0.5 M acetic acid and 0.5 M sodium acetate. The K_a of acetic acid is 1.7×10^{-5}.

2. Which of the following would be the best instrument to use to identify a low volatility liquid?

   a. HPLC
   b. GC
   c. IRMS
   d. Boiling Point Apparatus

3. If a chemical reaction is endothermic, what are the conditions under which it can still proceed spontaneously?

4. a.) Describe how to make 250 mL of a 0.25 M magnesium bromide solution.

   b.) Describe how to prepare 500 mL of a 0.05 M solution of magnesium bromide solution using the solution you prepared in (a).

5. What is the Brøsted-Lowry Theory definition of an acid?

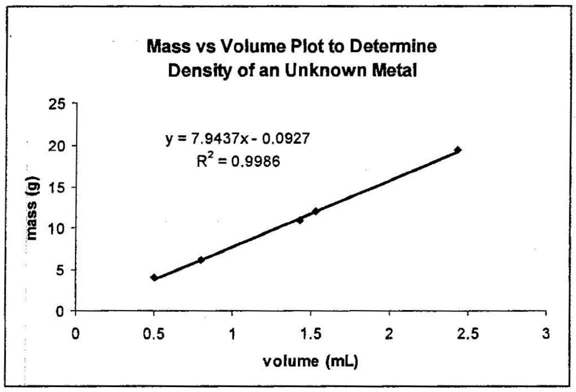
(a) An electron pair donor
(b) Produces OH^-
(c) A proton donor
(d) A proton acceptor
(e) Accepts an OH^-

6. Consider the reaction: $A + B \rightarrow C \quad K = 3*10^4$

Which of the following is true for this reaction?

______ Equilibrium lies far to the left
______ Equilibrium lies far to the right
______ This reaction proceeds slowly
______ This reaction proceeds fast

7. Based on the data below, what is the density of the metal?



8. You react $Li_{(s)}$ with $CuCl_2$ in water and observe bubbles, signaling a chemical reaction, and the disappearance of lithium, signaling it has been oxidized to Li^+. Which of the following is the best finding of the experiment?

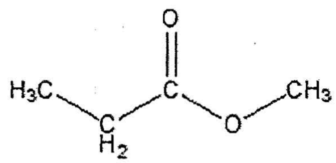
______ If Li has been oxidized, Cl^- must be reduced, so the gas must be Cl_2.

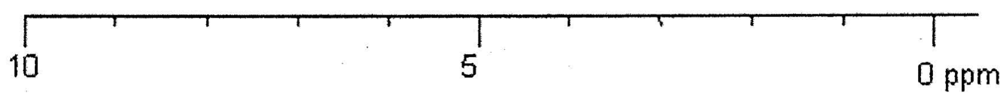
______ There was no smell of Cl_2 gas, so the gas must be Cu gas.

______ The reaction should be rerun twice, first with just $Li_{(s)}$ in water and second with $CuCl_2$ in water as controls.

9. Draw the Lewis structure for carbonate: CO_3^{2-}

10. Sketch the [1]H NMR spectrum for the molecule shown below.





11. Which of the following would be the best conclusion for a lab report?

a. I learned a lot and had fun.
b. I found the boiling point of methane, and it agreed with literature
c. The boiling point of methane was found to be – 161.02 ± 0.1 °C. This corresponds to a 2.3% difference from previously published work.
d. The boiling point of methane was found to be – 161.0 ± 0.1 °C. This corresponds to a 2% difference from previously published work.

12. Describe the signs of ΔS^{o}_{rxn} and ΔH^{o}_{rxn} for:

$$H_2\,(g) + O_2(g) \rightarrow H_2O(g)$$

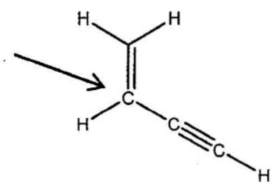
13. In the following reaction, which is run at 600 K, 2 moles of nitrogen gas are mixed with 3 moles of hydrogen gas:

$$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$$

How may moles of ammonia gas would be produced?

A. 0 mol
B. 1.5 mol
C. 2.0 mol
D. 2.5 mol
E. 4.0 mol

14. Consider the molecule below:



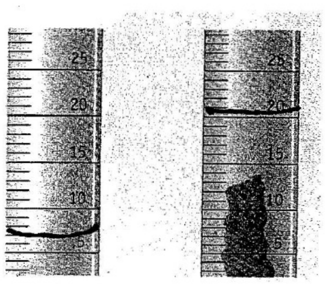
A) How many sigma (σ) and pi (π) bonds are in this molecule?

a. 5 σ and 2 π
b. 5 σ and 3 π
c. 5 σ and 5 π
d. 7 σ and 2 π
e. 7 σ and 3 π

B) What is the hybridization on the carbon that the arrow is pointing too?

a. sp
b. sp^2
c. sp^3
d. sp^3d
e. sp^3d^2

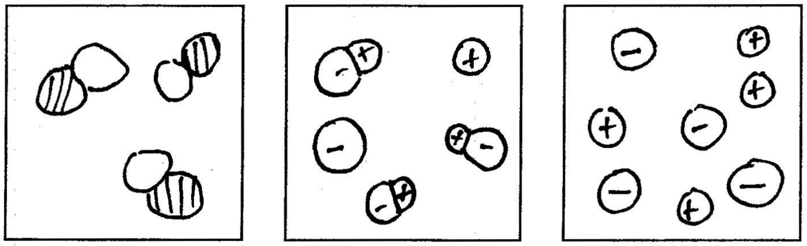
15. A student was trying to determine the density of an unknown metal. The student placed the metal in a graduated cylinder as shown below.



Using proper significant figures, calculate the volume of the metal.

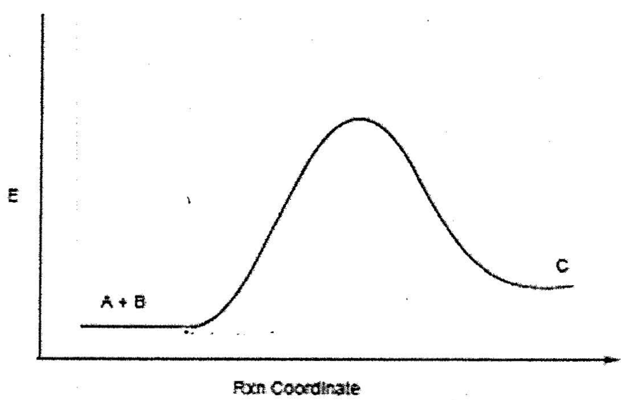
16. The concentration of $[H_3O^+]$ in Sauvignon Blanc (a white wine) is 5.89 X 10^{-4} M. The pH of a Cabernet Sauvignon (a red wine) is 3.64. Which is more acidic, white wine or red wine?

17. Aqueous solutions of three different substances AX, AY, and AZ are represented by the three diagrams below. Which of the substances would be classified as a weak electrolyte?



a. AX
b. AY
c. AZ
d. AY and AZ
e. AX, AY, and AZ (Any solute dissolved in water will form a solution classified as an electrolyte.

18. Consider the following reaction coordinate diagram for the reaction: A + B → C



a. Label the energetic differences related to the thermodynamics and kinetics of the reaction.

b. Use a dotted line to show the energetic profile for the conversion of A + B → that occurs at a faster rate than the reaction shown.

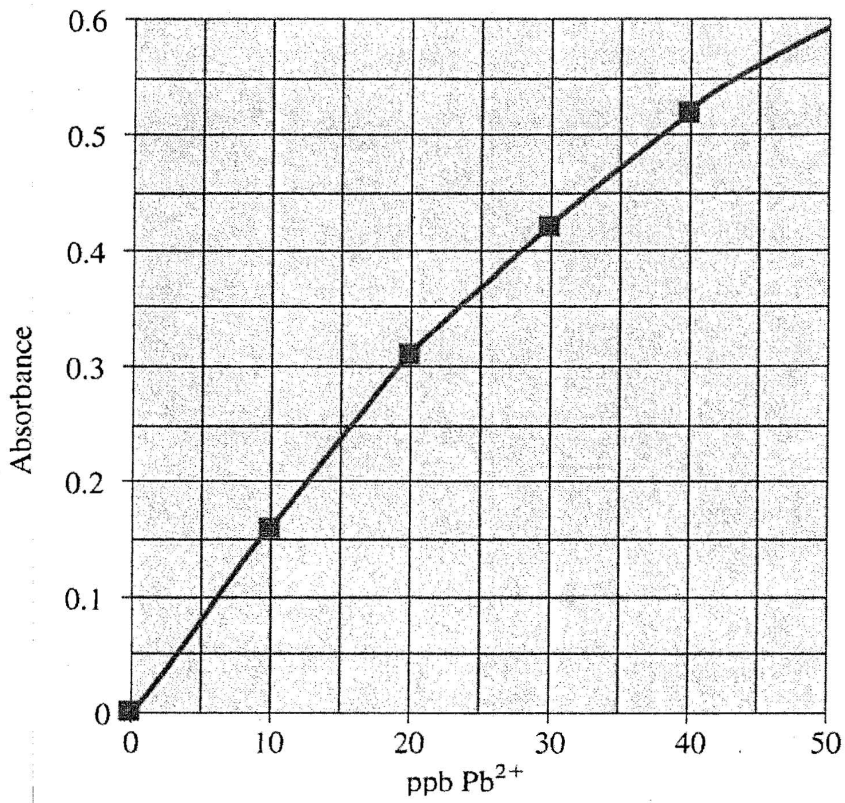
c. Answer the following questions True or False:

_____This reaction occurs spontaneously.

_____When the Reaction reaches equilibrium, there are more products present then reactants.

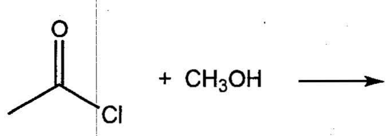
_____The addition of a catalyst will increase the amount of products present once equilibrium is established.

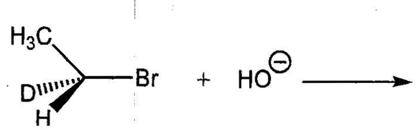
19. The figure shows a calibration curve for the spectrometric analysis of lead in water. According to the figure, a fair estimate of the concentration of lead in a sample with an absorbance of 0.25 is



A. 25 ppb.
B. 15 ppb.
C. 20 ppb.
D. 10 ppb.

20. Draw the products of the following reactions.





Appendix F

Student Presentations

Farmer student presentations

Poster entitled “Synthesis of Pyrazole Containing Aromatic Heterocycles.” Presented by Leah Knight. 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. Moraga, CA, May, 2009.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 22nd Annual CSU Biotechnology Symposium. Santa Clara, CA, January, 2010.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 239th Annual ACS National Meeting. San Francisco, CA, March, 2010.

Poster entitled “Synthesis of Fe_3O_4/polystyrene Core-Shell Nanoparticles Using Atom Transfer Radical Polymerization.” Presented by Jake Abel. 22nd Annual Northern California American Chemical Society Undergraduate Research Symposium. Sacramento, CA, May, 2010.

Poster entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Jeffry Verde. 23rd Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA, May, 2011.

Oral Presentation entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Rose Geranio. 24th Annual Northern California American Chemical Society Undergraduate Research Symposium. Mills College, Oakland, CA, April, 2012.

Fukuto Student Presentations

Samantha Carrington, oral presentation “The Chemical Biology of H_2S”, Northern California ACS Undergraduate Research meeting, May 8, 2010, Sacramento State University.

Tyler Chavez and Chris Bianco, poster “The Synthesis of HNO Donor Compounds”, Northern California ACS Undergraduate Research meeting, May 8, 2010, Sacramento State University.

Renee Kincade, oral presentation “Persulfide Biochemistry”, Northern California ACS Undergraduate Research meeting May 20, 2011, San Jose State University.

Cinthya Cisneros, oral presentation “The Chemistry and Biochemistry of Hydrogen Sulfide”, Northern California ACS Undergraduate Research meeting May 20, 2011, San Jose State University.

Victor Sosa, poster “The effect of HNO on the activity of thioredoxin reductase”, CSUPERB, 1/11/14, Santa Clara, California.

Robert Millikin, Corey White, poster “The reaction of HNO with selenols”, CSUPERB, 1/11/14, Santa Clara, California.

Lillig Student presentations

Poster entitled Poster entitled “Expression, Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Poster entitled Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Poster entitled Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Talk entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Talk entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Expression, Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Characterization of HotLap” presented by Albert Basso at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Expression, Purification, and Mutational Analysis of Carnobacteriocin B2” presented by Stella Katisi at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Summer Introduction to Research and Protein NMR” presented by Matt Applesmith at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Expression , Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis and Casee Barnes at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Talk entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Talk entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Talk entitled “Secondary Structure Predictions of Carnobacteriocin B2” presented by Brittany Anderson at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Poster entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes and Pete Arnold at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

Poster entitled “Secondary Structure Predictions of Carnobacteriocin B2” presented by Brittany Anderson at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

Talk entitled “Determining Binding Constant for Pentagastrin with Phospholipid Vesicles” presented by Gal Marcan at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

Talk entitled “Killing Listeria: the Effectiveness of Two Antibacterial Peptides” presented by Danelle Reddy at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

Paper entitled “Killing Listeria: The Effectiveness of Two Antibacterial Peptides” by Danelle Reddy, published in the Sonoma State McNair Research Journal (V.1), 2010.

Talk entitled “Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry.” Presented by Frankie Gonzales at the 22nd Annual Northern California Undergraduate Research Symposium. CSU Sacramento, May 2010.

Talk presented by research student Danelle Reddy at the California State University Student Research Competition, May 2010.

Poster entitled “Effect of Liposome Charge and Size on Mastoparan X Binding Measured by Isothermal Titration Calorimetry.” Presented by Frankie Gonzales at the 22nd Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2010.

Talk entitled “Troubleshooting the cloning of carnobacteriocin B2 as an intein fusion protein.” Presented by Amrit Dosanjh at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Talk entitled “Fluorescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Talk entitled “Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry.” Presented by Jennifer Pomponio at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Poster entitled “The Effects of Piscicocins V1a and V1b and their C-terminals on *Listeria ivanovii*.” Presented by Danelle Reddy at the SSU McNair Scholars Symposium. Rohnert Park, CA, April 2009.

Poster entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Determination of Binding Assocation of Mastoparan X to

Liposomes by Isothermal Titration Calorimetry.” Presented by Jennifer Pomponio at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Troubleshooting the cloning of carnobacteriocin B2 as an intein

fusion protein.” Presented by Amrit Dosanjh at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Membrane Activity of Piscicocins V1a and V1b Against *Listeria*

Innocua Determined by a Liquid Killing Assay.” Presented by Vanessa Fuller at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Flourescence Spectroscopy Analysis of Binding Activity of

Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Cloning and Expression of Carnobacteriocin B2 as an Intein

Fusion Protein.” Presented by Amrit Dosanjh at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Talk entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.”

Presented by Alene Seward at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Alene Seward and Kaitlin Fisher at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Poster entitled “Cloning and Expression of Carnobacteriocin B2 as an Intein

Fusion Protein.” Presented by Kristi Herrmann and Amrit Dosanjh at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Poster entitled “Membrane Activity of Piscicocins V1a and V1b Against *Listeria*

Innocua Determined by a Liquid Killing Assay.” Presented by Vanessa Fuller at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Perri Student Publications

B. Neufeld and M.J. Perri, "The Impact of Sonoma State University on the Water Quality of Copeland Creek Using Ion Chromatography," SSU Science Symposium, Sonoma State University, April, 2013.

M.J. Perri, C. Hoff, R. Mohs, B. Neufeld, S. Moltchanoff, “Measurements and Modeling of Rohnert Park’s Air and Water Quality,” Sonoma State University Faculty Research Exposition, March 27, 2013

S.Moltchanoff , C. Hoff, and M.J. Perri, “Evaluation of the Community Multiscale Air Quality Model,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

M.J. Perri, C. Hoff, R. Mohs, “Atmospheric Chemistry: Effect of Local Pollutants on the Troposphere,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

R. Mohs and M.J. Perri, “Measurements and Predictions of Local Air Pollution,” Sonoma State University Faculty Research Exposition, March 7, 2012

Works Student Presentations

1. “Chromium(III) binding to glutathione and transferrin.” Hank Seeley and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

2. “The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs” Jacob Barrett and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

3. “Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$” Jaimey Homen, Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

4. “Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents.” Talk- Carmen Works, 245rd National ACS Meeting, New Orleans, LA., 2013.

5. “The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs” Jacob Barrett and Carmen Works, NCUAC –talk Spring 2013.

6. “Binding Studies of Chromium(III) to glutathione and transferrin.” Hank Seeley and Carmen Works, NCUAC –talk Spring 2013.

7. Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$” Jaimey Homen, Carmen Works, NCUAC –poster Spring 2013.

8. “Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents.” Poster -Heidi van de Wouw, Peter Damon and Carmen Works, 243rd National ACS Meeting, San Diego CA, 2012.

9. “Quantum Yield Determinations of Iron-Iron Hydrogenase Model Compounds” Heidi van de Wouw and Carmen Works, talk, NCUR Symposium, Spring 2012.

10. “Isolation and Characterization of a Novel Chromium Binding Protein” J. Bernard and C. Works, CSU Student Research Competition, 2011.

11. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. CSU Student Research Competition, 2011.

12. “Photochemical Studies of Iron-Only Hydrogenase.” M. Pope and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

13. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

14. “Investigation for the Bioremediation of Chromium(VI) Using Pseudomonas veronii.” M. Herland, M. Haley, C. Works. 22nd Annual CSUPERB Symposium 2010.

15. “Characterization of a Chromium-Binding Protein.” J. Bernard, B. Wright, D. Hill and Carmen Works, 22nd Annual CSUPERB Symposium 2010.

16. “Photochemical Studies of an Iron-Only Hydrogenase” M. Pope, M. Lomotan, H. King and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010.

17. “Characterization of a Chromium Binding Protein” J. Bernard, B. Wright and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010

18. “Isothermal Calorimetric Studies of Chromium(III) with Various Ligands” N. Trimble and C. Works. 21st Annual Northern California ACS Undergraduate Research Meeting. 2010.

19. “Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Benard, J. Wright B., Hill, D., Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

20. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

21. “Evaluation of the Bacteria Growth of P. Verrnoii” Haley, M., Herland M., and Works C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

22. “Photochemical Studies of Model for Iron-Only Hydrogenase” Lomotan, M., Davis, M., Works, C.F. 21st Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

23. “Photochemical Studies of Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. SSU Faculty Expo Spring **2008**.

24. “Photochemical Studies of a Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. 20t Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

25. “Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Benard, J. Wright B., Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

26. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

27. “Interaction of Chromium(III) with EDTA“ Dugh, K. and Works, C.F. 20st Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

28. “Effects of Chromium(III) Binding Proteins on PTPase Activity“ 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

29. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

30. “Photochemical Studies of a Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. 19^{t} Annual Northern California ACS Undergraduate Research Meeting Sonoma May **2008**.

31. “Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** SSU Faculty Expo Spring **2006**.

32. “Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts.” Prescott, K.T.; White, S.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

33. “Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

34. “Reactivity of Chromium(III) with Biological Molecules.” E. Sterns and **C.F. Works** 18th Annual Northern California ACS Undergraduate Research Meeting. SJSU, San Jose CA May **2006**.

35. “Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts.” Prescott, K.T.; White, S.; **Works, C.F.** CSUPERB San Jose, CA January **2006**.

36. “Reactivity of Chromium(III) with Biological Molecules.” E. Sterns and **C.F.** CSUPERB San Jose, CA January **2006**.

37. “Isolation and Characterization of a Chromium Peptide from Bovine Liver.” R. Peterson, K. Banker, and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

38. “Purification of a Chromate Reductase from Pseudomonad.” D. Skarra and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

39. “Photochemical Studies of a Model Compound for Iron-Only-Hydrogenase.” J. Harr and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

40. “Reactivity of Chromium(III) with Biological Molecules.” E. Sterns and **C.F. Works** 17th Annual Northern California ACS Undergraduate Research Meeting. Mills College, Oakland CA April **2005**.

41. “Efficiency of Transferrin as a Chromium Transport Protein.” CSUPERB San Jose, CA January **2004**.

42. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” T. Garcia and **C.F. Works** CSUPERB San Jose, CA January **2004**.

43. “Biological Transport of Chromium(III) ions.” **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

44. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” D. Skarra and **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

45. “Kinetic Studies of the Reaction Between Chromium(III) and Transferrin.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

46. “Synthesis, Purification and Photochemical Studies of a Model Compound of the Iron-Only Hydrogenase Enzyme.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

47. “Probing MetalloProteins with Electrochemistry.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

48. “Kinetic Studies of Chromium(III) salts with apo-Transferrin in buffered aqueous solutions.” M.R. Cook and **C.F. Works** 14th Annual Northern California ACS Undergraduate Research Meeting. San Jose State University, CA 2002.

49. “Photochemistry of Ru(Salen)(NO)(X) compounds.” *Southern California Inorganic Photochemistry Conference*. Catalina Island, CA **1999, 1998, and 1997**.

Appendix G

Evaluation of Chemistry Student SI's

Supplemental Instruction -- Feedback Survey -- Fall 2013

1. What parent course did you attend SI tutoring for? Chem 125 Who was your SI Tutor? Michael Haggman

N=5

2. How many times have you attended the Supplemental Instruction sessions this semester? (Circle One)

0-4 times 5-10 times. (1) 10 or more times //// (4)

3. How helpful was attending the SI class? (Circle one)

1	2	3	4
Not Helpful	A Little Helpful	Mostly Helpful // (2)	Very Helpful /// (3)

4. How helpful was it to have the SI leader participate in the parent class, if they did? (Circle one)

1	2	3	4	5
Not Helpful	A Little Helpful (1)	Mostly Helpful /	Very Helpful //// (4)	Not applicable

5. What did you find most useful about the SI sessions?

- The 1on1 attention. Asks exactly what we want to go over; helps when it doesn't make sense.
- He gave us worksheets & treated them more like ~~tests~~ & explained confusing problem
- The worksheets & how he went over the problems thoroughly, Always asked what we wanted to go over.
- Practice tests were on point. They really covered the material. Some weren't as helpful as others.

6. How would you change the SI class to better meet your needs?

- wouldn't change anything - it really helps.

Nothing, The time worked for me & so did the tutor.

- Have students participate more & do problems on the board more
- Some questions give were way too hard & would never be on a test. It makes the material more confusing instead of making us more prepared.
- less people so you can focus on what you need help on.

7. Indicate how much you agree with each of the following statements:

Working with an SI leader improved my ability to ...	Strongly Disagree	Disagree	Agree	Strongly Agree
• better understand the material presented in class			/// (3)	// (2)
• improve the quality of my work			/// (3)	// (2)
• solve challenging problems			/// (3)	// (2)
• develop better study strategies			/// (3)	// (2)
• improve my overall performance in the course			// (2)	/// (3)
• increase my confidence as a student			//// (4)	/ (1)
• understand my learning strengths and weaknesses			/// (3)	// (2)
• organize my class materials			/// (3)	// (2)

Nov. 22, 2013

Supplemental Instruction -- Feedback Survey -- Fall 2013

1. What parent course did you attend SI tutoring for? Chem 335A Who was your SI Tutor? Jacob Barrett

N=4

2. How many times have you attended the Supplemental Instruction sessions this semester? (Circle One)

0-4 times   5-10 times. // 2   10 or more times // 2

3. How helpful was attending the SI class? (Circle one)

1	2	3	4
Not Helpful	A Little Helpful	Mostly Helpful	Very Helpful //// 4

4. How helpful was it to have the SI leader participate in the parent class, if they did? (Circle one)

1	2	3	4	5
Not Helpful	A Little Helpful	Mostly Helpful	Very Helpful // 2	Not applicable // 2

5. What did you find most useful about the SI sessions?

- Breaking down the material to make it simple.
- Extra worksheets; overall clarification of lecture material; asking questions
- worksheets
- He was kind & cared about the outcome of my grade/knowledge

6. How would you change the SI class to better meet your needs?

- more individual time

7. Indicate how much you agree with each of the following statements:

Working with an SI leader improved my ability to ...	Strongly Disagree	Disagree	Agree	Strongly Agree
• better understand the material presented in class				//// 4
• improve the quality of my work			/	/// 3
• solve challenging problems				//// 4
• develop better study strategies			/	/// 3
• improve my overall performance in the course				//// 4
• increase my confidence as a student			///	/ 1
• understand my learning strengths and weaknesses		/	/	// 2
• organize my class materials		/	/	// 2

Nov. 22, 2013

Supplemental Instruction -- Feedback Survey -- Fall 2013

1. What parent course did you attend SI tutoring for? Chem 335B Who was your SI Tutor? Victor Sosa

N=9

2. How many times have you attended the Supplemental Instruction sessions this semester? (Circle One)

   0-4 times //// 4 5-10 times. 卌 3 10 or more times /

3. How helpful was attending the SI class? (Circle one)

1	2	3	4
Not Helpful	A Little Helpful	Mostly Helpful //// 4	Very Helpful 卌 5

4. How helpful was it to have the SI leader participate in the parent class, if they did? (Circle one)

1	2	3	4	5
Not Helpful	A Little Helpful	Mostly Helpful	Very Helpful	Not applicable
	/	// 2	卌 5	/

5. What did you find most useful about the SI sessions?

- going over concepts and receiving extra problems to do / Many different pract. Prob
- Practicing problems & going more in-depth with the mechanisms was the most useful.
- It was much more 1 on 1 then classes. He also gave many more extra problems (3X)
- Different perspective supplemental to parent lecture
- Gave extra examples for me to do. Made me do the problem on my own & forced me to Think on The spot

6. How would you change the SI class to better meet your needs?

- The times were difficult for me to attend at times.
- Would have liked a few practice problems to be given out.
- The biggest issue I had was not being able to attend because of other classes or work.
- Wish both time slots worked w/ my schedule
- Better hours. Offer at different times

7. Indicate how much you agree with each of the following statements:

Working with an SI leader improved my ability to ...	Strongly Disagree	Disagree	Agree	Strongly Agree
• better understand the material presented in class			// 2	卌 / 6
• improve the quality of my work		/	// 2	//// / 5
• solve challenging problems			/// 3	//// / 5
• develop better study strategies		/	/// 3	//// 4
• improve my overall performance in the course			// 2	卌 / 5
• increase my confidence as a student		/	// 2	卌 5
• understand my learning strengths and weaknesses		/	/// 3	卌 5
• organize my class materials		/	//// 4	/// 3

Nov. 22, 2013

Appendix H

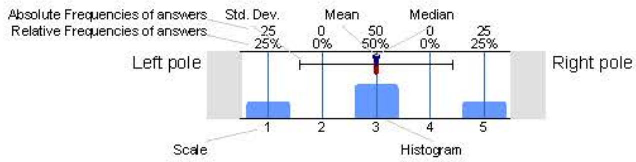
Chemistry Department Summary SETE's

CHEM

No. of responses = 858

Legend

Question text



n=No. of responses
av.=Mean
md=Median
dev.=Std. Dev.
ab.=Abstention

General Information

You are currently enrolled as a?

n=857

Freshman	218
Sophomore	228
Junior	195
Senior	208
Postbaccalaureate	8

Is this course required for your major?

n=856

Yes	696
No	160

Is this course required for General Education?

n=853

Yes	437
No	416

Is this course a pre-requisite for another course you need?

n=853

Yes	537
No	316

Are you taking this course as a non-major elective?

n=852

Yes	80
No	772

What grade do you expect to receive?

n=857

A	361
B	333
C	125
D	23
F	5
CR	9
NC	1
INC	0

Instructor Evaluation

		1	2	3	4	5		n	av.	md	dev.
My Instructor displays enthusiasm for teaching the course	Ineffective	24 (2.8%)	26 (3%)	70 (8.2%)	178 (20.8%)	556 (65.1%)	Very Effective	854	4.42	5	0.96
My Instructor is actively helpful when students have problems	Ineffective	43 (5%)	52 (6.1%)	78 (9.1%)	158 (18.5%)	522 (61.2%)	Very Effective	853	4.25	5	1.16
My Instructor clearly presents course information	Ineffective	44 (5.2%)	53 (6.2%)	104 (12.2%)	148 (17.3%)	505 (59.1%)	Very Effective	854	4.19	5	1.18
My Instructor seems well prepared for class	Ineffective	27 (3.2%)	27 (3.2%)	100 (11.7%)	153 (17.9%)	548 (64.1%)	Very Effective	855	4.37	5	1.02
My Instructor clearly explained the goals of the course	Ineffective	32 (3.7%)	30 (3.5%)	77 (9%)	166 (19.4%)	550 (64.3%)	Very Effective	855	4.37	5	1.04

Instructor Evaluation (cont.)

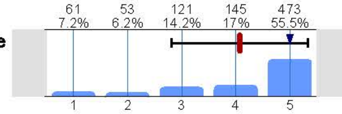
		1	2	3	4	5		n	av.	md	dev.
In this course, my Instructor enables me to participate actively in learning	Ineffective	31 (3.6%)	37 (4.3%)	94 (11%)	166 (19.5%)	525 (61.5%)	Very Effective	853	4.31	5	1.06
My Instructor respects different viewpoints	Ineffective	36 (4.2%)	35 (4.1%)	120 (14.1%)	154 (18%)	509 (59.6%)	Very Effective	854	4.25	5	1.1
My Instructor encourages me to do further independent study	Ineffective	30 (3.5%)	31 (3.6%)	107 (12.6%)	152 (17.9%)	531 (62.4%)	Very Effective	851	4.32	5	1.05
My Instructor provides opportunities to question ideas in class	Ineffective	35 (4.1%)	29 (3.4%)	104 (12.2%)	161 (18.8%)	526 (61.5%)	Very Effective	855	4.3	5	1.07

Instructor Evaluation (cont.)

		1	2	3	4	5		n	av.	md	dev.
The stated goals of this course are consistently pursued	Ineffective	27 (3.2%)	24 (2.8%)	77 (9%)	151 (17.7%)	573 (67.3%)	Very Effective	852	4.43	5	0.99
The Instructor displays competence in course topics	Ineffective	25 (2.9%)	28 (3.3%)	82 (9.6%)	135 (15.8%)	583 (68.3%)	Very Effective	853	4.43	5	0.99

My Instructor makes difficult topics understandable

Ineffective

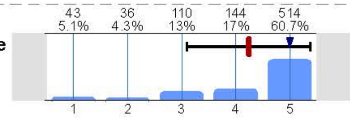


Very Effective

n=853
av.=4.07
md=5
dev.=1.26

My Instructor consults and advises effectively outside of class

Ineffective

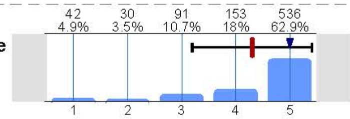


Very Effective

n=847
av.=4.24
md=5
dev.=1.14

My Instructor stimulates interest in the course

Ineffective



Very Effective

n=852
av.=4.3
md=5
dev.=1.11

Appendix I

Faculty Publications

Farmer Publications

1) **Farmer, S. C.**; Berg, S. H. Ring Contracting Sulfur Extrusion from Oxidized Phenothiazine Ring Systems. *Molecules* **2008**, 13, 1345-1352.

2) Morales, D. P.; Taylor, A. S.; **Farmer, S. C.** Desulfurization of Dibenzothiophene and Oxidized Dibenzothiophene Ring Systems. *Molecules* **2010**, 15, 1265-1269.

3) Farmer, S. C.; Pryor, L; Verde, J. Investigation of Fluorescent Molecules for Naematoloma fasciculare. *Abstracts of Papers, 239th ACS National Meeting 2010*, CHED-940.

4) Farmer, S. C. Organic Chemistry Trivia: A way to interest non-chemistry majors. *J. Chem. Ed.* **2011**, 88, 1648-1650.

5) Farmer, S. C. Using Social Networking Sites to Connect with Chemistry Alumni. *J. Chem. Ed.* **2013**, 90, 673-675.

6) Farmer, S. C. Continued Linear Growth of Organic Chemistry Textbooks
Chem. Educator **2013**, 18, 273-274.

7) Durmus, A.; Gunbas, G.; Farmer, S. C.; Olmstead, M. M.; Mascal, M; Legese, B.; Cho, J.; Beingessner, R. L.; Yamazaki, T.; Fenniri, H. Synthesis of N-substituted Pyrido[4,3-*d*]pyrimidines for the Large-Scale Production of Self-Assembled Rosettes and Nanotubes *J. Org. Chem.*, **2013**, *78* (22), 11421–11426.

Su publications

1) N. K. Srinivasan, M.-C. Su, J. V. Michael, A.W. Jasper, S.J. Klipperstein and L.B. Harding, "The Thermal Decomposition of CF_3 and The Reaction of $CF_2 + OH \rightarrow CF_2O + H$", *J. Phys. Chem. A* 112 (2008) 31.

2) R. Sivaramakrishnan, N. K. Srinivasan, M.-C. Su and J. V. Michael, "High Temperature Rate Constants for OH + Alkanes", *Proc. Combust. Inst.* 32 (2009) 107.

3) S.J. Klippenstein, L.B. Harding, B. Ruscic, R. Sivaramakrishnan, N. K. Srinivasan, M.-C. Su and J.V. Michael, "The Thermal Decomposition of NH_2OH and Subsequent Reactions: Ab Initio Transition State Theory and Reflected Shock Tube Experiments", *J. Phys. Chem. A* 113 (2009) 10241.

4) R. Sivaramakrishnan, M.-C. Su, J.V. Michael, S.J. Klippenstein, L.B. Harding, and B. Ruscic, “Rate Constants for the Thermal Decomposition of Ethanol and Its Bimolecular Reactions with OH and D: Reflected Shock Tube and Theoretical Studies”, *J. Phys. Chem. A* 114 (2010) 9425.

5) R. Sivaramakrishnan, M.-C. Su, J.V. Michael, S.J. Klippenstein, L.B. Harding, and B. Ruscic, “Shock Tube and Theoretical Studies on the Thermal Decomposition of Propane for a Roaming Radical Channel”, *J. Phys. Chem. A* 115 (2011) 3366.

6) Sebastian L. Peukert, Raghu Sivaramakrishnan, Meng-Chih Su and Joe V. Michael, “Experiment and theory on methylformate and methylacetate kinetics at high temperatures: Rate constants for H-atom abstraction and thermal decomposition”, Combustion and Flame 159 (2012) 2312.

7) S. Peukert, R. Sivaramakrishnan, M-C Su and Joe V. Michael, “High Temperature Rate Constants for H/D + Methyl Formate and Methyl Acetate”, Proc. Combust. Inst., (2012) in press.

8) Christopher M.T. Campbell1, Matthew T. Fontana1, Benjamin C. Taggart1, Meng-Chih Su, Chung-Lun Lin, Huan-Cheng Chang, Hui-Jung Chen, “Acid Denaturation and Refolding of Cytochrome c on Silica Surface”, *J. Chin. Chem. Soc*. (2013) in press.

Fukuto Pulications

1) Norris, A. J., Sartippour, M. R., Lu, M., Park, T., Rao, J. Y., Jackson, M. I., Fukuto, J. M. and Brooks, M. N. (2008) Nitroxyl Inhibits Breast Tumor Growth and Angiogenesis, *Int. J. Cancer*, 122, 1905-1910.

2) Pervin, S., Tran, A. H., Zekavati, S., Fukuto, J. M., Singh, R. and Chaudhuri, G. (2008) Increased Susceptibility of Breast Cancer Cells to Stress Mediated Inhibition of Protein Synthesis, *Cancer Res*., 68, 4862-4874.

3) Miller, T. W., Cherney, M. E., Lee, A. J., Francoleon, N., Farmer, P. J., King, S. B., Hobbs, A. J., Miranda, K., Burstyn, J. N. and Fukuto, J. M. (2009) The Effects of Nitroxyl (HNO) on Soluble Guanylate Cyclase Activity: Interactions at Ferrous Heme and Cysteine Thiols, *J. Biol. Chem*., 284, 21788-21796.

4) Jackson, M. I., Han, T. H., Serbulea, L., Dutton, A., Ford, E., Miranda, K. M., Houk, K. N., Wink, D. A. and Fukuto, J. M. (2009) Kinetic Feasibility of Nitroxyl (HNO) Reduction by Physiological Reductants and Biological Implications, *Free Radic. Biol. Med*., 47, 1130-1139.

5) Ostrowski, A. D., Deakin, S. J., Azhar, B., Miller, T. W., Franco, N., Cherney, M. M., Lee, A., Burstyn, J. N., Fukuto, J. M., Megson, I. L. and Ford, P. C. (2010) Nitric oxide photogeneration from *trans*-$Cr(cyclam)(ONO)_2^+$ in a reducing environment. Activation of soluble guanylate cyclase and arterial vasorelaxation, *J. Med. Chem*., 53, 715-722.

6) Kumar, M. R., Fukuto, J. M., Miranda, K. M. and Farmer, P. J. (2010) Reactions of HNO with heme proteins: New routes to HNO-heme complexes and insight into physiological effects, *Inorg. Chem*., 49, 6283-6292.

7) Jourd'heuil, D., Lancaster, J. R. Jr., Fukuto, J. M., Roberts, D. D., Miranda, K. M., Mayer, B., Grisham, M. B. and Wink, D. A. (2010) The bell-shaped curve for peroxynitrite-mediated oxidation and nitration of NO/O_2^- is alive and well, *J. Biol. Chem*., 285, 15.

8) Francoleon, N. E., Carrington, S. J. and Fukuto, J. M. (2011) The Reaction of H_2S with Oxidized Thiols: Generation of Persulfides and Implications to H_2S Biology, *Arch. Biochem. Biophys.*, 516, 146-153.

9) Gurung, S., Cohen, M. F., Fukuto, J. and Yamasaki, H. (2012) Polyamine-induced rapid root abscission in *Azolla pinnata*, *J. Amino Acids*, vol. 2012, article ID 493209. 9 pages.

10) Switzer, C. H., Miller, T. W., Farmer, P. J. and Fukuto, J. M. (2013) Synthesis and Characterization of Lithium Nitroxyl, *J. Inorg. Biochem*., 118, 128-133.

11) Sen, S., Kawahara, B., Fukuto, J. and Chaudhuri, G. (2013) Induction of a Feed Forward Pro-Apoptotic Mechanism Loop by Nitric Oxide in a Human Breast Cancer Model, PLoS One, 8, e70593

12) Jackson, M. I., Fields, H. F., Lujan, T. S., Cantrell, M. M., Lin, J. and Fukuto, J. M. (2013) The Effects of Nitroxyl (HNO) on H_2O_2 Metabolism and Possible Mechanisms of HNO Signaling, *Arch. Biochem. Biophys*., 538, 120-129.

13) Heinrich, T. A., Tedesco, A. C., Fukuto, J. M. and da Silva, R. S. (2013) Production of reactive oxygen and nitrogen species by light irradiation of a nitrosyl phthalocyanine ruthenium complex as a strategy for cancer treatment, *Dalton Trans*. DOI: 10.1039/c3dt52217b

14) Ida, T., Sawa, T., Ihara, H., Kasamatsu, S., Kunieda, K., Tsuchiya, Y., Watanabe, Y., Kumagai, Y., Nishida, M., Suematsu, M., Motohashi, H., Fujii, S., Matsunaga, T., Yamamoto, M., Ono, K., Devarie-Baez, N. O., Xian, M., Fukuto, J. M. and Akaiake, T. (2013) Reactive cysteine persulfides and S-polysulfuration regulate oxidative stress and redox signaling, *Proc. Natl. Acad. Sci., USA,* submitted, 2014.

Lillig Publications

1) ***Laird, D., *Mulvihill, M. and Whiles Lillig, J. "Membrane-Induced Peptide Structural Changes Monitored by Infrared and Circular Dichroism Spectroscopy."** ***Biophys Chem*** **145, 72-8 (2009).**

2) Whiles Lillig, J. "Changing the Focus of the Standard Term-Paper to Encourage Critical Data Analysis in the Upper-Division Chemistry Classroom" *J. Chem. Education* **85***,* 1392-1394 (2008).

Perri Publications

Ortiz-Montalvo, D. L.; Lim, Y. B.; Perri, M. J.; Seitzinger, S. P.; Turpin, B. J., "Volatility and Yield of Glycolaldehyde SOA Formed through Aqueous Photochemistry and Droplet Evaporation," Aerosol Science and Technology (2012), 46 (9), 1002-1014.

Perri, M.J., Y.B. Lim, S.P. Seitzinger, B.J. Turpin, "Organosulfates from glycolaldehyde in aqueous aerosols and clouds: Laboratory studies," Atmospheric Environment (2010), doi:10.1016/j.atmosenv.2010.03.031

Lim, Y.B., Tan, Y., Perri, M.J., Seitzinger, S.P. and Turpin, B.J., 2010. Aqueous chemistry and its role in secondary organic aerosol (SOA) formation. Atmos. Chem. Phys. Discuss. 10, 14161-14207.

Works Publications

1. Advance Inorganic Lab Experiment: Synthesis and Characterization of μ-$S_2Fe_2(CO)_6$. Barrett, J. Spentzo, A., **Works, C**. *Journal of Chemical Education* submitted **2013**.

2. Flash Photolysis and Continuous Photolysis of an Iron-Iron Hydrogenase Model (μ-pdt)$[Fe(CO)_3]_2$ in Different Solvents; Insight into the Inhibition by CO. Marhenke, J.; Pierri, A.; Lomotan, M.; Ford, P.C. *Inorganic Chemistry* **2011**, 50 (23) 11850-11852.

3. Oxidation of Chromium(III) Binding Proteins and Implications for Insulin Activity in Glucose Metabolism. White, S.A., **Works, C.F**. *Journal of Undergraduate Chemistry Research* **2010**, 9(2) 36-38.

4. Photochemical studies of iron-only hydrogenase model compounds Brown-McDonald, J., Berg, S., Peralto, M., **Works, C** *Inorganica Chimica Acta* **2009**, 362, (2) 318-324.

5. Isolation of a Novel Chromium(III) Binding Protein from Bovine Liver Tissue After Chromium(VI) Exposure. Ryan L. Peterson, Kelly J. Banker, Thelma Y. Garcia, and **Carmen F. Works**. *Journal of Inorganic Biochemistry*. **2008** (102) 833–841.

Appendix J

Faculty Successful Grants

Farmer Successful Funding

Co-PI, Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics. National Science Foundation. “Collaborative Research: Advancing Undergraduate Chemistry Education with Dynamic Open-Access ChemWiki HyperTextbook.” $28,000. Submitted May 2012.

CO-PI, Major Research Instrumentation Acquisition. National Science Foundation. “MRI: The Acquisition of a 400 MHz NMR Spectrometer.” $329,513. (2011).

Principal Investigator, Research, Scholarship, and Creative Activity Program. Sonoma State University. “Investigation of fluorescent molecules from Naematoloma Fasciculare.” $2,735 (2011).

Principal Investigator, Research, Scholarship, and Creative Activity Program. Sonoma State University. “Synthesis of Pyrazole Containing Aromatic Heterocycles.” $2,235 (2007).

Su Successful Funding

2008:Department of Energy, Argonne National Labs: $9,000.

2009:Department of Energy, Argonne National Labs: $12,880.

2010:Department of Energy, Argonne National Labs: $9,000.

2011:Department of Energy, Argonne National Labs: $9,000.

2012:Department of Energy, Argonne National Labs: $9,000.

Fukuto Successful Funding

“Biological Chemistry and Pharmacology of Nitroxyl (HNO)”, PI, NIH R15, 8/1/2011 – 7/31/2014, $356,987 direct costs.

“The Chemical Biology of Hydrogen Sulfide”, PI, NSF RUI, 2/1/2012 – 1/31/2015, $300,000 direct costs.

Lillig Successful funding

Sonoma State University, through the Green Music Center Board of Trustees and the University Affairs Committee, Academic Integration Project Award. “Utilization of the Green Music Center to Expose the SSU Community to Chemistry Through Two Unique Lecture Events.” $10,000 (2013-2014), PI.

Agilent Foundation “STEMpowering THE FUTURE.” $8,430 (2013, cont. from 2012), co-PI. Funds the Agilent summer research academy.

Sonoma State University Research, Scholarship, and Creative Activity Program Mini-Grant. "Determination of Antibacterial Activity of Four Mutated Protein Antibiotics." $4464 (2013), PI.

Sonoma State University Research, Scholarship, and Creative Activity Program Summer Fellowship. "Structural Characterization of a Protein by NMR." $5780 (2012), PI.

National Science Foundation Major Research Instrumentation Grant. "Acquisition of a 400-MHz NMR Spectrometer." $308,454 (2011-2014), PI.

California State University Program for Education and Research in Biotechnology Faculty Development Award. "Mutagenesis and Modeling Studies of the Antimicrobial Peptide Carnobacteriocin B2." $14,993 (2011-2012), PI.

Sonoma State University Research, Scholarship, and Creative Activity Program. "A Preparation of Mutant Anti-Bacterial Proteins for Structure:Function Analysis." $4217 (2011), PI.

Agilent Foundation Award. "STEM Saturday and Research Academies" $18, 400 (2011-2012), Academy Leader.

California State University Program for Education and Research in Biotechnology Travel Grant. $1000 (2010-2011), PI.

National Science Foundation Major Research Instrumentation Grant. "Acquisition of an isothermal titration calorimeter and differential scanning calorimeter." $183,488 (2007-2009), CO-PI.

Perri Funding

M.J. Perri (2014). Measurements of organic pesticides in our local environment. WATERS collaboration funds, $1650

M. Haggmark (2013). Measurements of organic pesticides in our local environment. Instructionally Related Activity – research award, $750

M.J. Perri (2013). Measurements of organic pesticides in our local environment. Provost Professional Development Funds, $1000

M.J. Perri (2013). Measurements of organic pesticides in our local environment. SST Professional Development Funds, $1969

M.J. Perri (2013). Measurement of Anion Concentrations in Copeland Creek. WATERS collaboration funds, $1250

M.J. Perri (2012). Measurement of Anion Concentrations in Copeland Creek. SST Professional Development Funds, $2300

M.J. Perri (2012). Organic Pollutants in Copeland Creek. Sonoma State University RSCAP, $2677

S. Moltchanoff and M.J. Perri (2012). Evaluation of the Community Multiscale Air Quality Model NASA Spacegrant / MESA Summer Research Award, $3000

R. Mohs and M.J. Perri (2012). Atmospheric Chemistry: Effect of Local Pollutants on the Troposphere NSF STEM Summer Research Award, $3000

M.J. Perri (2011). Impact of Alternative Transportation on our Local Air Quality. Sonoma State University RSCAP, $4365

M.J. Perri (2011). Impact of Alternative Transportation on our Local Air Quality. SST Professional Development Funds, $1000

M. Weisman, M.J. Perri (2011). Investigation of the Copeland Creek Water Quality. part of the SSU Service Learning Grant, $1537

M.J. Perri (2011). Travel Grant to Attend WRF Tutorial. SST Professional Development Funds, $1500

M.J. Perri (2011). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. SST Professional Development Funds, $1000

M.J. Perri (2011). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. SST Professional Development Funds, $1424

M.J. Perri (2010). Atmospheric Measurements of Local Conditions and Correlation with Pollution Events. Sonoma State University RSCAP, $3232

M.J. Perri (2009). Predicting Future Trends in Ground Level Ozone in the North Bay and US Region. Sonoma State University RSCAP, $1840

Works Funded Grants

1. **Co-PI NSF-MRI- Acquisition of a high field NMR $349,058. FUNDED**

2. **PI – NSF RUI Funding for Iron-only hydrogenase project. $ 130,673. FUNDED AT $129,754. JULY 2011**

3. PI – Faculty Seed Grant CSUPERB for $15,000. FUNDED for $10,000.

4. Collaborator, "Acquisition of a MALDI-TOF MS System for the College of Natural Sciences and Mathematics, California State University Long Beach." Keck Foundation. FUNDED $724,131

5. PI - RSCAP mini grant sponsored programs for support of undergraduate research. SSU. FUNDED $2,000

6. Faculty Mentor - Howell-CSUPERB young investigator Award for undergraduate research. FUNDED $2,500

7. PI - RSCAP mini grant SSU office of sponsored programs for support of undergraduate research during the summer. $4,200. Funded

8. PI - for CSUPERB grant for curriculum development in the amount of $15,000. FUNDED

9. PI - RSCAP summer stipend in the amount of one-month salary to support summer research. Funded

10. Faculty Mentor - Howell-CSUPERB young investigator Award for undergraduate research. $2,500. Funded

Appendix K

Faculty Presentations

Farmer student presentations

Poster entitled “Synthesis of Pyrazole Containing Aromatic Heterocycles.” Presented by Leah Knight. 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. Moraga, CA, May, 2009.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 22nd Annual CSU Biotechnology Symposium. Santa Clara, CA, January, 2010.

Poster entitled “Investigation of fluorescent molecules from *Naematoloma Fasciculare*.” Presented by Leslie Pryor. 239th Annual ACS National Meeting. San Francisco, CA, March, 2010.

Poster entitled “Synthesis of Fe_3O_4/polystyrene Core-Shell Nanoparticles Using Atom Transfer Radical Polymerization.” Presented by Jake Abel. 22nd Annual Northern California American Chemical Society Undergraduate Research Symposium. Sacramento, CA, May, 2010.

Poster entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Jeffry Verde. 23rd Annual Northern California American Chemical Society Undergraduate Research Symposium. San Jose, CA, May, 2011.

Oral Presentation entitled “Investigation of Fluorescent Molecules From Naematoloma fasciculare.” Presented by Rose Geranio. 24th Annual Northern California American Chemical Society Undergraduate Research Symposium. Mills College, Oakland, CA, April, 2012.

Fukuto Student Presentations

Samantha Carrington, oral presentation “The Chemical Biology of H_2S”, Northern California ACS Undergraduate Research meeting, May 8, 2010, Sacramento State University.

Tyler Chavez and Chris Bianco, poster “The Synthesis of HNO Donor Compounds”, Northern California ACS Undergraduate Research meeting, May 8, 2010, Sacramento State University.

Renee Kincade, oral presentation “Persulfide Biochemistry”, Northern California ACS Undergraduate Research meeting May 20, 2011, San Jose State University.

Cinthya Cisneros, oral presentation “The Chemistry and Biochemistry of Hydrogen Sulfide”, Northern California ACS Undergraduate Research meeting May 20, 2011, San Jose State University.

Victor Sosa, poster “The effect of HNO on the activity of thioredoxin reductase”, CSUPERB, 1/11/14, Santa Clara, California.

Robert Millikin, Corey White, poster “The reaction of HNO with selenols”, CSUPERB, 1/11/14, Santa Clara, California.

Lillig Student presentations

Poster entitled Poster entitled “Expression, Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Poster entitled Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Poster entitled Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 1st Annual SSU Science Symposium, SSU Green Music Center, May 2013.

Talk entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Talk entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Expression, Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Characterization of HotLap” presented by Albert Basso at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Expression, Purification, and Mutational Analysis of Carnobacteriocin B2” presented by Stella Katisi at the 25th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Santa Clara University, CA, May 2013.

Poster entitled “Summer Introduction to Research and Protein NMR” presented by Matt Applesmith at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Expression , Purification, and Isolation of Carnobacteriocin B2” presented by Nick Pasadis and Casee Barnes at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Determination of the IC50 for Class IIa Bacteriocins via a Liquid Killing Assay” presented by Kelsey Goldbeck at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Poster entitled “Solid Phase Synthesis of Piscicocin V1a” presented by Agya Karki at the 25th California State University Program for Education and Research in Biotechnology Symposium. Anaheim, CA, January 2013.

Talk entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Talk entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Talk entitled “Secondary Structure Predictions of Carnobacteriocin B2” presented by Brittany Anderson at the 24th Annual American Chemical Society Annual Northern California Undergraduate Research Symposium. Mills College, Oakland, CA May 2012.

Poster entitled “Expression, Purification, and Mutation of Carnobacteriocin B2” presented by Casee Barnes and Pete Arnold at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

Poster entitled “Secondary Structure Predictions of Carnobacteriocin B2” presented by Brittany Anderson at the 24th Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2012.

Talk entitled “Determining Binding Constant for Pentagastrin with Phospholipid Vesicles” presented by Gal Marcan at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

Talk entitled “Killing Listeria: the Effectiveness of Two Antibacterial Peptides” presented by Danelle Reddy at the 23rd American Chemical Society Annual Northern California Undergraduate Research Symposium. San Jose State University, May 2011.

Paper entitled “Killing Listeria: The Effectiveness of Two Antibacterial Peptides” by Danelle Reddy, published in the Sonoma State McNair Research Journal (V.1), 2010.

Talk entitled “Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry.” Presented by Frankie Gonzales at the 22nd Annual Northern California Undergraduate Research Symposium. CSU Sacramento, May 2010.

Talk presented by research student Danelle Reddy at the California State University Student Research Competition, May 2010.

Poster entitled “Effect of Liposome Charge and Size on Mastoparan X Binding Measured by Isothermal Titration Calorimetry.” Presented by Frankie Gonzales at the 22nd Annual California State University Program for Education and Research in Biotechnology Symposium. Santa Clara, CA, January 2010.

Talk entitled “Troubleshooting the cloning of carnobacteriocin B2 as an intein fusion protein.” Presented by Amrit Dosanjh at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Talk entitled “Fluorescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Talk entitled “Determination of Binding Association of Mastoparan X to Liposomes by Isothermal Titration Calorimetry.” Presented by Jennifer Pomponio at the 21st Annual Northern California American Chemical Society Undergraduate Research Symposium. St. Mary’s College, California, May 2009.

Poster entitled “The Effects of Piscicocins V1a and V1b and their C-terminals on *Listeria ivanovii*.” Presented by Danelle Reddy at the SSU McNair Scholars Symposium. Rohnert Park, CA, April 2009.

Poster entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Determination of Binding Assocation of Mastoparan X to

Liposomes by Isothermal Titration Calorimetry.” Presented by Jennifer Pomponio at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Troubleshooting the cloning of carnobacteriocin B2 as an intein

fusion protein.” Presented by Amrit Dosanjh at the 21st Annual California State University Program for Education and Research in Biotechnology Symposium. Los Angeles, CA, January 2009.

Poster entitled “Membrane Activity of Piscicocins V1a and V1b Against *Listeria*

Innocua Determined by a Liquid Killing Assay.” Presented by Vanessa Fuller at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Flourescence Spectroscopy Analysis of Binding Activity of

Piscicocins V1a and V1b.” Presented by Kaitlin Fisher at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Cloning and Expression of Carnobacteriocin B2 as an Intein

Fusion Protein.” Presented by Amrit Dosanjh at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Talk entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.”

Presented by Alene Seward at the 20th Annual Northern California American Chemical Society Undergraduate Research Symposium. Santa Clara, CA, May 2008.

Poster entitled “Flourescence Spectroscopy Analysis of Piscicocins V1a and V1b.” Presented by Alene Seward and Kaitlin Fisher at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Poster entitled “Cloning and Expression of Carnobacteriocin B2 as an Intein

Fusion Protein.” Presented by Kristi Herrmann and Amrit Dosanjh at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Poster entitled “Membrane Activity of Piscicocins V1a and V1b Against *Listeria*

Innocua Determined by a Liquid Killing Assay.” Presented by Vanessa Fuller at the 20th Annual California State University Program for Education and Research in Biotechnology Symposium. Oakland, CA, January 2008.

Perri Student Presentations

B. Neufeld and M.J. Perri, "The Impact of Sonoma State University on the Water Quality of Copeland Creek Using Ion Chromatography," SSU Science Symposium, Sonoma State University, April, 2013.

M.J. Perri, C. Hoff, R. Mohs, B. Neufeld, S. Moltchanoff, “Measurements and Modeling of Rohnert Park’s Air and Water Quality,” Sonoma State University Faculty Research Exposition, March 27, 2013

S.Moltchanoff , C. Hoff, and M.J. Perri, “Evaluation of the Community Multiscale Air Quality Model,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

M.J. Perri, C. Hoff, R. Mohs, “Atmospheric Chemistry: Effect of Local Pollutants on the Troposphere,” ACS Undergraduate Research Symposium, Mills College, April, 2012.

R. Mohs and M.J. Perri, “Measurements and Predictions of Local Air Pollution,” Sonoma State University Faculty Research Exposition, March 7, 2012

Works Student Presentations

1. “Chromium(III) binding to glutathione and transferrin.” Hank Seeley and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

2. “The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs” Jacob Barrett and Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

3. “Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$” Jaimey Homen, Carmen Works, CSUPERB 26th Annual CSU Biotechnology Symposium, 2014.

4. “Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents.” Talk- Carmen Works, 245rd National ACS Meeting, New Orleans, LA., 2013.

5. “The Synthesis and Characterization of Iron-iron Hydrogenase Model Compounds for use as Potential Photo-CORMs” Jacob Barrett and Carmen Works, NCUAC –talk Spring 2013.

6. “Binding Studies of Chromium(III) to glutathione and transferrin.” Hank Seeley and Carmen Works, NCUAC –talk Spring 2013.

7. Photochemical studies of possible photo-induced CO releasing molecule μ-(1,3-pdt)-$[Fe(CO)_3)]_2$” Jaimey Homen, Carmen Works, NCUAC –poster Spring 2013.

8. “Photochemical Studies of Iron-Iron Hydrogenase Model Compounds in Various Solvents.” Poster -Heidi van de Wouw, Peter Damon and Carmen Works, 243rd National ACS Meeting, San Diego CA, 2012.

9. “Quantum Yield Determinations of Iron-Iron Hydrogenase Model Compounds” Heidi van de Wouw and Carmen Works, talk, NCUR Symposium, Spring 2012.

10. “Isolation and Characterization of a Novel Chromium Binding Protein” J. Bernard and C. Works, CSU Student Research Competition, 2011.

11. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. CSU Student Research Competition, 2011.

12. “Photochemical Studies of Iron-Only Hydrogenase.” M. Pope and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

13. “Isolation and Purification of Chromate Reductase from Novel Pseudomonas veronii.” M. Lomotan and C. Works. ACS 23rd Annual Northern California Undergraduate Research Symposium. 2011.

14. “Investigation for the Bioremediation of Chromium(VI) Using Pseudomonas veronii.” M. Herland, M. Haley, C. Works. 22nd Annual CSUPERB Symposium 2010.

15. “Characterization of a Chromium-Binding Protein.” J. Bernard, B. Wright, D. Hill and Carmen Works, 22nd Annual CSUPERB Symposium 2010.

16. “Photochemical Studies of an Iron-Only Hydrogenase” M. Pope, M. Lomotan, H. King and C. Works. 21^{st} Annual Northern California ACS Undergraduate Research Meeting. 2010.

17. “Characterization of a Chromium Binding Protein” J. Bernard, B. Wright and C. Works. 21^{st} Annual Northern California ACS Undergraduate Research Meeting. 2010

18. “Isothermal Calorimetric Studies of Chromium(III) with Various Ligands” N. Trimble and C. Works. 21^{st} Annual Northern California ACS Undergraduate Research Meeting. 2010.

19. “Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Benard, J. Wright B., Hill, D., Works, C.F. 21^{st} Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

20. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 21^{st} Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

21. “Evaluation of the Bacteria Growth of P. Verrnoii” Haley, M., Herland M., and Works C.F. 21^{st} Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

22. “Photochemical Studies of Model for Iron-Only Hydrogenase” Lomotan, M., Davis, M., Works, C.F. 21^{st} Annual Northern California ACS Undergraduate Research Meeting St. Marys May **2009**.

23. “Photochemical Studies of Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. SSU Faculty Expo Spring **2008**.

24. “Photochemical Studies of a Model for Iron-Only Hydrogenase” McDonald, J. Works, C.F. 20^{t} Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

25. “Characterization of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure.” Benard, J. Wright B., Works, C.F. 20^{st} Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

26. “The Analysis of the Enzymatic Reduction of Chromium” Pritchard, D.C. and Works, C.F. 20^{st} Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

27. “Interaction of Chromium(III) with EDTA“ Dugh, K. and Works, C.F. 20^{st} Annual Northern California ACS Undergraduate Research Meeting Santa Clara May **2008**.

28. "Effects of Chromium(III) Binding Proteins on PTPase Activity" 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

29. "The Analysis of the Enzymatic Reduction of Chromium" Pritchard, D.C. and Works, C.F. 19st Annual Northern California ACS Undergraduate Research Meeting Sonoma State May **2008**.

30. "Photochemical Studies of a Model for Iron-Only Hydrogenase" McDonald, J. Works, C.F. 19t Annual Northern California ACS Undergraduate Research Meeting Sonoma May **2008**.

31. "Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure." Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** SSU Faculty Expo Spring **2006**.

32. "Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts." Prescott, K.T.; White, S.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

33. "Isolation of a novel chromium(III) binding protein from bovine liver tissue after chromium(VI) exposure." Peterson, R.L.; Banker, K.J.; Garcia, T.Y.; **Works, C.F.** 18th Annual Northern California ACS Undergraduate Research Meeting San Jose May **2006**.

34. "Reactivity of Chromium(III) with Biological Molecules." E. Sterns and **C.F. Works** 18th Annual Northern California ACS Undergraduate Research Meeting. SJSU, San Jose CA May **2006**.

35. "Isolation and Characterization of transition metal binding proteins from bovine liver using cobalt(III) salts." Prescott, K.T.; White, S.; **Works, C.F.** CSUPERB San Jose, CA January **2006**.

36. "Reactivity of Chromium(III) with Biological Molecules." E. Sterns and **C.F.** CSUPERB San Jose, CA January **2006**.

37. "Isolation and Characterization of a Chromium Peptide from Bovine Liver." R. Peterson, K. Banker, and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

38. "Purification of a Chromate Reductase from Pseudomonad." D. Skarra and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

39. "Photochemical Studies of a Model Compound for Iron-Only-Hydrogenase." J. Harr and **C.F. Works** CSUPERB Los Angeles, CA January **2005**.

40. “Reactivity of Chromium(III) with Biological Molecules.” E. Sterns and **C.F. Works** 17th Annual Northern California ACS Undergraduate Research Meeting. Mills College, Oakland CA April **2005**.

41. “Efficiency of Transferrin as a Chromium Transport Protein.” CSUPERB San Jose, CA January **2004**.

42. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” T. Garcia and **C.F. Works** CSUPERB San Jose, CA January **2004**.

43. “Biological Transport of Chromium(III) ions.” **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

44. “Isolation and Charaterization of Chromium(VI) Tolerant Soil Bacillus.” D. Skarra and **C.F. Works** 2004 Faculty Expostion of Scholarship and Sponsored Research at Sonoma State University April 21, **2004**.

45. “Kinetic Studies of the Reaction Between Chromium(III) and Transferrin.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

46. “Synthesis, Purification and Photochemical Studies of a Model Compound of the Iron-Only Hydrogenase Enzyme.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

47. “Probing MetalloProteins with Electrochemistry.” 15th Annual Northern California ACS Undergraduate Research Meeting. University of San Francisco, CA **2003**.

48. “Kinetic Studies of Chromium(III) salts with apo-Transferrin in buffered aqueous solutions.” M.R. Cook and **C.F. Works** 14th Annual Northern California ACS Undergraduate Research Meeting. San Jose State University, CA 2002.

49. “Photochemistry of Ru(Salen)(NO)(X) compounds.” *Southern California Inorganic Photochemistry Conference*. Catalina Island, CA **1999, 1998, and 1997**.

Appendix L

Suggestions made from previous external reviewer

Summary of Recommendations:

1. **Have staff report to the Department Chair.** One of the unusual findings (at least from my perspective) is that the staff members in the Department do not report to the Chair of the Department, but rather to a separate staff administrator. Although this arrangement may be found at other Universities, I find it to be rather arcane and can potentially exacerbate conflicts, rendering them unresolved (indeed this has been the case in this Department over the particular issue of safety/student access to research laboratories during summers). I do not know if it is possible within the administrative framework of SSU, but I make the recommendation that the administrative hierarchy be changed so that clerical and technical staff members report directly to the Chair of the Department, and that the Chair be responsible for their supervision and evaluation.

2. **M.S. Chemistry Degree.** The development of an M.S. Chemistry program should be looked into, but delayed for at least 5 years, until the size of the Department (faculty and staff, as well as physical space) reaches the critical mass necessary to sustain a graduate program.

3. **Support Necessary from SSU Contracts and Grants Office.** The SSU Contracts and Grants Office needs to be put in order. Several faculty members complained about the grant submission process at SSU-that there was not only a distinct lack of support for faculty members submitting grant proposals, but in fact this office was viewed as a hindrance or obstacle in getting proposals out the door. It is increasingly vital that this office provide support for faculty members to apply for grants as the faculty as a whole becomes more research active. This office must provide encouragement for grant submission, rather than discouragement. Also, there were complaints about the lack of experience by personnel at Contracts and Grants- they must be knowledgeable about the grant programs to which faculty apply to, and provide support to faculty members in going through the application process.

4. **Facilities.** Facilities upgrade/expansion must be planned to allow for:
    a. Faculty research-space is needed for future tenure-track hires to occupy, present faculty need more research space.
    b. Research facilities with modern instrumentation.
    c. Faculty offices for new tenure-track and part-time faculty.
    d. Teaching labs for an expanded teaching program.
    e. Chemical Storeroom within the Departmental area.
    f. Student Club area (present one is shared with Physics students).
    g. Department office (presently shared with Physics).

5. **Outreach to Alumni.** There is a need to re-connect to the alumni of the Department. The Department has already begun to make some inroads with respect to th1s (e.g. Departmental newsletter has been started, with significant contributions from the chemistry club in putting it together, planned alumni reception). It would be useful for the Department to keep in regular touch with its alumni. My sense is that graduates of Sonoma State often stay fairly local within Sonoma County and nearby counties, and that there is a strong pride and loyalty to the University. The alumni are the "product" of your efforts, and the relationship with them should be continuously

cultivated. This may lead to some eventual success with respect to development, but this should not be viewed or portrayed as the primary reason for fostering these relationships.

6. **Outreach to Emeriti Faculty.** Another set of relationships that I believe it is important to foster is that with the Emeriti Faculty. The Department should reach out to Emeriti Faculty and by doing so build bridges to the past history of the Department, which is rich. It is important to re-connect with these former faculty members, who were also passionate about the Department, the students and the job that they performed. There was a philosophical shift that occurred in transitioning to the modern department (one that has a much greater emphasis on research and scholarly activity); a philosophy that some of the emeriti faculty members may not share. However, the Emeriti faculty is still an asset, and I suspect that they will be delighted at being asked back to the Department. A Departmental lunch or dinner with the Emeriti faculty, on a regular basis, would be one way to maintain the connection. A regular award to an Emeritus/Emerita professor, for past or continued contributions to the Department, is one suggestion that I make. Also, the present Department can invite the Emeriti faculty back for a tour- I suspect that in spite of any differences that there might have once been in philosophical beliefs for the future direction of the Department, the Emeriti faculty will be glad to see any current endeavors by the Department, and will share your enthusiasm for your. recent accomplishments.

7. **Nature of New Tenure-track hires. Start-up packages.** There needs to be a continued, and even augmented focus on new faculty who do research, and in particular those who will actively involve undergraduate students in their research program performing real, cutting-edge and publishable research (not simply creating independent projects for undergraduates).

   The Department should explore with the current administration any mechanisms in which start-up packages for incoming faculty can be augmented- to increase the probability of hiring new quality faculty members as well as to enhance their probability of success in establishing a productive research program, thereby leading to tenure and promotion.

   As part of this exercise, the Department should consider the area; of research cuncntly pcrfonucd Within the Department, and should then determine whether they wish to concentrate in certain core area; of research, or hire faculty who have research areas complementary to the current faculty. Both systems have advantages and disadvantages, so it is important to consider this before further hiring in tenure track positions occurs.

8. **Number of New Tenure-track hires.** The Department clearly needs to recruit more faculty members in tenure-track positions, given the expansion of the teaching program (that has already occurred, and that is anticipated to occur- both in majors and in service to other majors). The current Departmental plan to build to 8 sounds about right to me, but I would recommend that a comprehensive 5-year plan be developed, in which a justification is made for future faculty hires in each area of· chemistry (with respect to the nature of the research area as well as the area of teaching expertise). This should be done by taking into account future retirements or other anticipated attrition; projections for

enrollment, based upon in part: new degree programs offered, anticipated demand from other departments, anticipated number of majors; projected teaching needs in each division within chemistry based upon projections for number of sections needed, etc.

9. **Development of a Departmental Safety Policy.** The Department should develop a comprehensive safety policy and document this in the form of a written report to the Dean and Provost. This needs to include a firmly stated policy with respect to students working in research labs, nights and weekends, and breaks including summers. Student research activity of this nature, and at these times, is certainly a necessity for any viable university research program- but is important to ensure that maximum safeguards are in place to protect your students, staff and faculty. No chemical research facility can be guaranteed to be accident-proof, but all safety measures consistent with current modem laboratory practices should be in place, with the appropriate level of training of all personnel involved, notification and documentation of current practices to both researchers and the administration, and with strict enforcement of the safety rules.

10. **Chemistry Club should become Student Affiliate of the American Chemical Society (SAACS).** The Department has an active chemistry club that is an important part of the students' lives for those who are chemistry majors, and is an important support mechanism for their studies, in addition to being a social outlet. The Department advisor for the club should begin the application process to make the club an official chapter of SAACS (the Student Affiliates of the American Chemical Society).

11. **Additional Technical Staff.** The Department has a clear need for additional staff help in Chemistry stockroom/instrumentation maintenance. Mr. Nels Worden cannot be expected to continue to shoulder the entire burden of both running the Chemistry stockroom as well as maintaining the laboratory facilities and instrumentation. This will become increasingly evident as more research active faculty come into the Department bringing additional instrumentation. Also, additional help will be needed if the teaching program were to grow any larger than it is presently. The Chair has a plan to use student help in the Chemistry stockroom as part of a "senior service component" required for graduation, which may be helpful but I believe that the Department needs to consider a more viable, long- term solution.

12. **Development.** A development plan is needed for the department to help with future growth needs, particularly in the area of facilities. Dean Rahimi mentioned his anticipation of grant applications from Chemistry to fund laboratory facilities akin to the present Keck center for Physics. The University should attempt to assist the Department with respect to their developmental needs – expert assistance, such as the hiring of a development officer, could be of significant benefit.

13. **Computational Chemistry in the Curriculum.** I recommend that the Department begin to incorporate and integrate computational chemistry throughout the curriculum. Some use of computers for laboratory exercises already occurs, but I suggest putting together a computer laboratory that takes advantage of currently available software packages for computational chemistry that can be utilized beginning as early as general chemistry, and then integrated throughout the entire curriculum. No programming skills are needed by the students in the use of this software. In addition to using computational chemistry packages as an addition to the instructor's arsenal for introducing new concepts, other uses of software in chemistry can be taught, such as doing calculations and plotting using Excel, etc.

14. **Additional Departmental Retreats.** I recommend strongly that the Department have another/additional retreats (I should point out that the current Chair already started this process, and mentioned that he was already planning on the next retreat), focusing on assessment, the future direction of Department, etc. The retreat{s) should concentrate on the following goals:
    a. To develop a 5-year plan, including projection for number of faculty and the area(s) of research.
    b. To come up with a comprehensive assessment plan with learning objectives (SLOs) for each course and throughout each degree plan (w/matrix).
    c. To identify Departmental efforts that can be undertaken to expand/improve current and future facilities for research, instrumentation and teaching laboratories.
    d. To plan for the submission of grant proposals for departmental instrumentation that can be shared amongst current and future faculty members in their research.

15. **Assigned Time for Lecturers.** A mechanism must be found to pay Lecturers (part-time faculty members) for tasks that they are asked to perform above and beyond their teaching (which is exclusively what they are paid to do), such as curricular development, advising students, etc.

16. **Open Access for Faculty to Chemistry Stockroom.** Faculty members need to have open access to chemical stockroom for materials and equipment, both for their research as well as for the teaching labs. A system should be put into place for the faculty to a) have access to chemicals and reagents; b) have access to the stockroom both during regular business hours and off-hours; c) be able to check out these materials on the "honor" system. This needs to be done in a cooperative and sensitive way taking into consideration the opinions of Mr.Nels Worden, the Chemistry Department Stockroom Technician, who is fastidious and keen to maintain his sense of order and organization.

Department of Chemistry TT Hiring Plan

Current # majors: 180, we have no plans for significant growth of the major

Current # TT Faculty: 7

-2 biochemists

-2 organic chemists

-2 physical/analytical chemists

-1 inorganic chemist

Need # TT/permanent Faculty: 10

1. Materials/Inorganic Chemistry
   a. Teaching area: CHEM 125AB, 255, 275, 325, 401, 402
   b. Service to school: CHEM 102, 110, 115AB
2. Computational/Physical Chemistry
   a. Teaching area: CHEM 125AB, 275, 401, 310AB
   b. Service to school: CHEM 102, 110, 115AB
3. Permanent Coordinator for General Chemistry, expertise may vary
   a. Teaching area: CHEM 115AB
   b. Service to school: in addition to teaching CHEM 115AB, responsibilities will be to coordinate the multiple lab sections, additional adjunct faculty teaching labs, and supplemental instructors

***Note:** This # of faculty and their expertise are the need to currently serve our majors, school, and university. Retirements/loss of faculty would require filling the vacancy of expertise left by that position.

First Hire: Gen Chem Coordinator

Department of Chemistry By-Laws

Updated and Approved: September 12, 2014

Chemistry Department Rules of Engagement

- We won't talk at the same time. The chair will maintain a speaker's list when appropriate.
- We will formulate conclusions and plans from our discussions when appropriate. We will try to reach consensus in our decision making process but if necessary, core faculty will vote.
- We will provide overviews of items on the table before jumping into the details.
- Members of the core faculty can motion to table items for future discussion.
- We will come prepared to the meetings.
- We will be active participants in our core meetings.
- We will do our best not to take things personally.

I. Department of Chemistry RTP Procedures.

This document, prepared by the Department Committee for Review, Tenure and Promotion and approved by the Chemistry Department on November 25, 2008, provides guidance to candidates for reappointment, tenure and promotion. The document is divided into two sections: I. RTP Procedures which describes procedural requirements by the candidate and the departmental RTP committee; and II. Evaluation Criteria which describes the criteria by which candidates will be evaluated. Both policies and criteria are intended to conform with general University policy.

RTP Procedures.
The Department follows the procedures described in the SSU document entitled "Reappointment, Tenure, and Promotion Procedures, Criteria, and Standards for Tenured and Probationary Faculty" (policy #1995-2), effective July 2, 2008 (http://www.sonoma.edu/uaffairs/policies/rtp.htm). In addition to those procedures the Chemistry Department requires the following from each candidate and the Departmental RTP committee. Section a) describes the candidate's responsibilities for providing documentation of his or her accomplishments in the area of teaching, research and scholarship, and service. Section b) describes the candidate's responsibilities in preparation of the annual RTP review document. Section c) describes the generation of the Working Personnel Action File (WPAF), which is the responsibility of the departmental RTP Committee.

In their first probationary year, candidates will write a self-expectation guideline based on the university and department criteria. This should be done with the consult of the departmental RTP committee and/or the department Chair.

a) Collection of material in the candidate's WPAF All untenured faculty members, and those seeking promotion, must maintain a collection of material providing evidence of his or her accomplishments in the areas of Teaching, Scholarship and Research, Service to the University, and Service to the Community. This collection is called the "Working Personnel Action File," or WPAF, in the University policy statements. The Chemistry Department will refer to this collection as the candidate's "RTP binder." The RTP binder provides the evidence from which RTP recommendations are supported.

This material will be collected by the candidate in a three-ring binder with divisions for the four review areas. The collected material associated with the current review will sub-divided into the four areas of evaluation (*vide infra*) and be placed at the beginning of the binder. Material from past RTP cycles is to be placed in separate sections behind the current materials in the binder. The candidate is free to add whatever material she or he thinks is relevant. Candidates have one week to reply, if they choose to, to material added by others to their WPAF. Candidates should consult the university policy for more particular information on addition of material to the RTP binder. The department RTP committee recommends that each candidate pay particular attention to the timely organization of his or her RTP binder.

Each year the university publishes a date by which each WPAF is closed to further addition of material (*vide infra*). However, department RTP committees may choose an earlier closing date. The chemistry department closing date is **7 days prior** to the university date.

The candidate's RTP binder should be divided into the sections listed below. The first page of each major section should contain an index to materials pertaining to the current RTP cycle. This organization and index will help RTP committee members as they write the candidate's evaluation document.

1. Teaching - list of classes taught and number of students enrolled, letters of evaluation by colleagues (peer evaluations), evaluation data from students (both comments and numerical data), and other evidence of accomplishments in teaching. A self-assessment/evaluation of the candidate's teaching should also be included. This narrative should follow the guidelines in section 4b-iii below.

2. Scholarship and Research - copies of published papers, submitted papers, papers in press, evidence of public presentation, evidence showing activity in seeking funding, letters from colleagues regarding scholarly efforts and other evidence relating to this area. A self-assessment/evaluation of the candidate's scholarship and research should also be included, using the guidelines in section 4b-iii below.

3. Service to the university – evidence of service to the university, letters from committee chairs regarding service on campus committees or other campus initiatives. A self-assessment/evaluation of university service should be included, using the guidelines in section 4b-iii below.

4. Service to the community – evidence of service to the community, including evidence of involvement in professional or civic capacities.

b) Candidate's responsibilities in the preparation of RTP documents: Each candidate has the responsibility to submit the following three items to the Chair of the Department RTP committee. These items must be submitted prior to the department closing date; this date is defined in section a) above as one week prior to the published University closing date.

i) A current CV prepared in a professionally acceptable manner. This document will become part of the candidate's RTP evaluation document.

ii) A current Self-evaluation. This document is inserted into the candidate's RTP evaluation document each cycle. A well-written narrative describing the candidate's achievements in the three primary areas under review (Teaching, Scholarship and Research and Service to the University). The candidate should carefully describe his or her achievements and their significance. All candidates should report, each RTP cycle, on their plans for professional development and research over the upcoming RTP cycle. Candidates should cite evidence contained in the WPAF. The department RTP committee will use this narrative to construct the RTP document. The length of this narrative should be in keeping with the length limitations imposed by university policy for the particular probationary year under review.

c) The Working Personnel Action File (WPAF): The following section is an abbreviated and slightly modified version of section 1.C.3.a-e from the "Sonoma State University Policy: Reappointment, Tenure and Promotion Procedures, Criteria and Standards for Tenured and Probationary Faculty" document (found at http://www.sonoma.edu/aa/fa/rtp.shtml). The WPAF contains all documents and materials that are to be forwarded to school/campus RTP committees. It is the responsibility of the departmental RTP committee to organize and accumulate the items in this file (many of which are found in the candidates WPAF binder). **Ten** copies of the WPAF are to be fastened with two-pronged fasteners at the top to be forwarded. This file is to contain the following items:

1. "Record of Action Taken" form: This form is generated by the faculty affairs office and is available from the Departmental office. The top section of this form is to be filled out by the Departmental RTP committee and signed by the Chair of the committee and the candidate.

2. "Chemistry Department RTP Committee Recommendation and Signature Sheet": This form is to be signed by the entire departmental RTP committee and the candidate and includes a brief synopsis of the reasoning behind the decision.

3. An updated Curriculum Vitae.

4. The departmental RTP evaluation document (no longer than 10 pages): The contents and format of this document are described in the "Sonoma State University Policy: Reappointment, Tenure and Promotion Procedures, Criteria and Standards for Tenured and Probationary Faculty", section 1.C.c (policy #1995-2).

5. Attachments:
   a. Departmental Criteria (this document).
   b. Department Chair Report (if any). (I.F.2.a-c)*
c. Self-assessment of Teaching and Professional Activity. (I.C.3.b.ii and II.B.2.c)*
   d. Peer Observations of Teaching (two). (I.C.3.b.iii and II.B.2.a)*
e. Summaries of Student Evaluations (two student evaluations from two courses). (I.C.3.b.iv and II.B.2.b)*
f. Transcriptions of Student Written Comments. (II.B.2.b.i)*
g. Location and Index of Materials available for examination. (I.C.3.c)* This can be the "Table of Contents" from the candidate's PAF and a page indicating the location of the WPAF.
h. Additional Attachments, if any (I.C.3.b.v-vi, I.F.3.b, I.F.4.b)*
i Letter of Appointment and Letter(s) or Reappointment (I.C.3.a.iv)*.
j. Previous Evaluation Documents (I.C.3.f, D.3, F.2.c)*. For reappointment and tenure candidates, include **all** previous SSU evaluation documents (the back sections in the PAF binder).

* refers to the sections in the "Sonoma State University Policy: Reappointment, Tenure and Promotion Procedures, Criteria and Standards for Tenured and Probationary Faculty".

The schedule and deadlines for the RTP process can be found online at http://www.sonoma.edu/aa/fa or in section 1.D.3-5 of the "Sonoma State University Policy: Reappointment, Tenure and Promotion Procedures, Criteria and Standards for Tenured and Probationary Faculty" document.

II. Department of Chemistry RTP Criteria

As required by University policy, the Chemistry Department evaluates candidates on his or her teaching, scholarship, service to the university and service to the community. The Chemistry Department regards teaching excellence and effective scholarly and research activities as most important. An adequate record of service to the university is important and expected. Community service will also be considered positively.

The Chemistry Department is guided by university policy in collection and evaluation of evidence of teaching effectiveness, scholarship and research, and service to the university and community.

Expectations for Teaching Performance

The Chemistry Department expects all candidates for tenure to have established a record of effective teaching. The following indicators will be used to evaluate the effectiveness of the candidate’s teaching.

1. Peer evaluations performed during the period of evaluation should show that the candidate conducts effective classroom activities, including effective lecturing techniques, appropriate response to student questions and approaches which encourage active involvement of students in the classroom. This evaluation should be based on at least two visits to lecture/lab by the evaluator and perusal of the course syllabus and, possibly, exams/quizzes. In addition, peer evaluations should examine other aspects of the candidate’s teaching, including for example: appropriate selection of course material; effective laboratory activities; and appropriate use of technology. Following the completion of the evaluation, the candidate may request to meet with the peer evaluator to discuss the contents of the evaluation.

2. Student evaluations should show, on average, that students regard the candidate as an effective teacher. Further, candidates should show that they have addressed areas of weakness, which may be raised in student evaluations.

3. Candidates should be involved in teaching a variety of classes as appropriate to the department’s needs, e.g., GE, lower-division and upper-division courses.

4. Candidates should show evidence of meeting office hours and working effectively with students outside of the classroom.

5. Effective team or collaborative teaching will also be evaluated as it is likely that the candidate's expertise will enhance the quality of courses not directly assigned to the candidate.

6. Mentorship of students is an important aspect of the candidate's responsibility. It should be clear that the candidate has mentored students in research activities and in making career path decisions.

Expectations for Scholarship, Research, and Professional Development

The Department defines professional development as scholarship, research, creative achievement, and continuing education. Some professional development activities may be considered under other criteria as well, such as teaching effectiveness or service to the University or to the community. Activities in professional development should be an active part of a candidates' progress from the beginning of their careers, although the nature and scope of those activities may change with time.

The Chemistry Department expects all candidates for tenure to have established an on-going scholarship and research component, which involves SSU undergraduate students. The level of departmental expectation in this regard is, however, highly dependent on the candidate having reasonable departmental and school support. For example, the candidate should have reasonable teaching loads, appropriate space, ample opportunity/time to secure funds and allowed reasonable access to existing funds and facilities.

The following indicators will be used to evaluate the effectiveness of candidate's work in the area of scholarship, research and professional development.

1. The candidate should establish an on-going research program, which involves work with SSU chemistry majors. Aspects of this work may take place at other universities or non-academic institutions. However, the bulk of this work should take place in SSU laboratories, or in other academic or research settings.

2. Scholarly work may result in refereed publication, presentation and/or participation at professional meetings, student presentations, reviews or other ways in which scholarly work can be publicly shared. Candidates for tenure and promotion should make efforts to publish or make known their research.

Proper evaluation of research activity is of paramount importance since there are often times no simple or standard criteria by which research can be judged. The goal of this work is to train undergraduate students in the activity of laboratory research. Unlike the laboratory activities associated with most Chemistry courses, this endeavor needs to be novel and designed for possible publication in acceptable, peer-reviewed journals. It is generally understood that the nature of research indicates that not all activities will result in publication and that timely publication is not always possible. Therefore, if no clear, tangible evidence of research activity/productivity is available then an evaluation of the inherent scholarship of this research needs to undertaken by the Departmental RTP committee. The committee may choose to recruit outside help (researchers at other institutions with the proper expertise) for help in making this evaluation.

3. Candidates should show continuing efforts to secure funding to support their research and work with SSU students or to support course or laboratory development. Successful grants activity may include on-campus sources such as the RSCAP program, which supports the efforts of junior faculty. Candidates may also turn to collaborative partnerships with local non-academic institutions to support that research.

4. It is strongly recommended that candidates undergoing tenure evaluation consider presenting their research in a Departmental seminar within 6 months of submission of the RTP documents. This seminar should be open to and attended by Chemistry students, other faculty and the RTP committee. Tenure candidates are also strongly encouraged to present their research at meetings and/or other institutions, especially if this provides the opportunity for the RTP committee to solicit expert opinions from talk attendees as to the quality and/or novelty of the work. These activities will be especially important if tangible evidence of productivity is lacking.

5. There is the general expectation that the research being carried out by the candidate involves undergraduate students and will result in eventual publication. For the evaluation of tenure it is expected that the amount and quality of work performed be equivalent to at least two publications in acceptable, peer-reviewed journals. In cases where actual publications are lacking, it will be important for the RTP committee, possibly with outside assistance, to make this evaluation.

Expectations for Service to the University and Community

The Department requires that each faculty member share the work of running of the Department by serving on departmental committees, being responsible for departmental equipment and facilities, advising students, and coordinating departmental activities as necessary.

1. Chemistry faculty members in their first year are not expected to share fully in committee work and student advising. They should, however, begin to contribute to Departmental functions by joining appropriate departmental committees and they should familiarize themselves with the operations of the School and University.

2. Candidates are encouraged to participate in school and university governance committees during their probationary period. However, evaluation of service will be largely based on the needs of the department, school and university.

3. We recognize advising is an essential aspect of university service. Examples of faculty contributions to the advising process include but are not limited too:

a. department advising
b. development of expertise in advising
c. participation in advising training programs
d. developing advising protocols and materials
e. organizing or participating in group advising sessions
f. participating in university wide advising programs
g. participation in summer or weekend advising programs such as SeaWolf Day or summer orientation
h. training new faculty

4. Candidates should show a record of some involvement in outreach to the community. Outreach activities could include student recruitment, establishing internships with local non-academic institutions or other forms of professional involvement with the community.

5. Candidates may establish a record of service to the community through their active involvement in a variety of community organizations. Of course, candidates can also serve the community in professional capacities like consultancies.

Procedures for evaluation of Temporary Faculty
Chemistry Department
Sonoma State University

On 15 May, 2002, the President of Sonoma State University (SSU) approved a "Periodic Evaluation of Temporary Faculty" policy (PETF). All faculty should refer to the MOU and SSU University policies (http://www.sonoma.edu/facaffairs/) for specific details regarding the evaluation process. The Department of Chemistry will follow the procedures outlined in the PETFP and herein provides procedures specific to the Department.

All official documents pertaining to a faculty member are kept by the Associate Vice President of Faculty Affairs in a document referred to as the Personnel Action File (PAF). The PAF contains letters of appointment, changes in appointment level, documentation of refusal of an offer of appointment by a temporary faculty member, and evaluation documents. A faculty member may view her/his file at any time, and can enter items into it. Any administrator of faculty matters can enter items, provided that the faculty member is notified in advance. *Any item helpful to the evaluation, positive or negative, may be entered*. As provided for in the MOU, a faculty member has five days to respond to proposed entries and may appeal a decision to add materials to the PAF. Administrators of faculty affairs may also view the PAF. A signed access log records all such viewings.

Annual peer evaluations of adjunct faculty will be submitted to Faculty Affairs by the department chair for inclusion in the PAF. Adjunct faculty who wish to submit additional student evaluations, not included in the annual review document, to Faculty Affairs for inclusion in their PAF may do so.

I. Committee organization and responsibilities

The term "Temporary Faculty Evaluation Committee" (TFEC) shall be understood to include a review committee of full-time tenured faculty, elected by the department for the evaluation of temporary faculty. This committee shall contain at least three full-time tenured faculty and will be the same members as the Chemistry Department RTP committee. This committee is responsible for summarizing student evaluations, selecting peer observers and performing evaluations/review of all temporary faculty (c.f. II.A PETF)

II. Level of Review

Temporary faculty with a full-time annual appointment in one department shall be evaluated annually. Levels of review will include: 1. Department Temporary Faculty Evaluation Committee 2. Dean

Temporary faculty with annual appointments that are less than full-time shall be evaluated annually. Levels of review will include: 1. Department chair or Department Temporary Faculty Evaluation Committee 2. Dean, at the dean's discretion

III. Materials to be used in evaluation

The materials that will be included in the evaluation are 1) student evaluations, 2) peer observation, 3) curriculum vitae, and 4) other materials (c.f. III. PETF).

Student Evaluations- Adjunct faculty should obtain student evaluations for every class each term they teach. As with tenure-track faculty, two sets of student evaluations will be used in the evaluation document. The adjunct faculty member should meet with the chair of the TFEC committee to select which evaluations shall be included in the evaluation document in order to provide a thorough, representative, and fair review. Information in evaluations will be summarized by the TFEC Committee and provided to the temporary faculty member for comment before inclusion in the evaluation (c.f. III.A PETF). For temporary faculty with annual appointments, evaluations from the previous one or two semesters shall be included.

Peer observations- A minimum of one peer observation shall be conducted during each review cycle. An additional peer observation may be required based on recommendations by the TFEC or at the request of the faculty member under review. Any tenure/tenure-track faculty member is eligible to conduct a peer observation (c.f. I.E. PETF). The Department Chair shall select observers to recommend to the temporary faculty member. If those observers are accepted, they shall arrange a suitable time for the visit with the temporary faculty member and receive a course outline and representative course materials (including examinations, laboratory exercises, and lecture handouts) from the temporary faculty member.

Following the peer observation, the observer shall submit a class observation document that includes: 1) Instructor, 2) Class, 3) Observer, 4) Time and Date, 5) Number of students in attendance, 6) Number of students enrolled, 7) Topics discussed in class, 8) Level of student participation and acceptance of student input, 9) Teaching styles and methods observed, 10) Problems that could be improved, 11) Utility of materials made available to students, 12) Utility of documents that clarify course goals and grading policy, 13) Utility and methods used to evaluate students, 14) Laboratory protocols and directions if applicable, 15) Course strengths, 16) Course weaknesses, and 17) Recommendations for instructor.

Class observation documents must be completed within 14 days of the class session observed and at least one week prior to the temporary faculty member's deadline for submission of her/his materials to the TFE Committee for evaluation (c.f. III.B. PETF).

If an adjunct faculty member is teaching a new course, or one they have not taught in the past three years, they must obtain a peer evaluation by a tenure-track faculty member for this class.

Curriculum vitae- If the evaluation is conducted more than one year after the temporary faculty member's initial appointment, a new curriculum vitae must be submitted to the TFE Committee by the temporary faculty member.

Other materials- The TFEC or temporary faculty member may decide on other materials that bear on the evaluation of the faculty member's performance (c.f. III.C PETF). All such materials are kept in a reference binder in the department office and must be submitted on or before the published date when materials are to be assembled.

Examples of such materials are evidence of the faculty member's service to the university, if any; evidence of curricular innovations in the faculty member's courses or the faculty member's professional development; instructional materials such as course syllabi or study guides; or communications from students, other faculty, or campus staff or administrators; or additional student or peer evaluations.

The chair of the TFEC or designee shall be responsible for assembling materials on which the evaluation shall be based. The party responsible for assembling the materials on which the evaluation shall be based will forward to the faculty member a copy of any materials not provided by the faculty member.

IV. Evaluation Procedures

A. At each level of evaluation, a copy of the evaluator's or evaluating body's report must be provided to the faculty member by the deadline.
B. A faculty member may provide a rebuttal to an evaluation. This rebuttal shall become part of the file of materials to be evaluated at subsequent levels of review. If the rebuttal is submitted for any level of review other than the first, the faculty member shall provide a copy of his/her rebuttal to all previous levels of review.
C. When the evaluation is completed, the following materials shall be forwarded to the Faculty Affairs Office for filing in the Personnel Action File: summaries of student evaluations of teaching

effectiveness, peer observations, evaluations by all levels of review, rebuttal statement(s) by the faculty member, and a list of any other materials used in the evaluation of the faculty member

D. The individual providing the last level of review shall forward the evaluation as defined above to the Faculty Affairs Office and shall notify the faculty member of his/her action, providing the faculty member a copy of the materials to be included in the Personnel Action File.

Evaluation Schedule

The temporary faculty in the department must be notified of this schedule at least ten working days before the first deadline in the schedule.

Full-Time Temporary Faculty

February 15: Chair or designee assembles materials to be used as the basis for evaluation. Faculty member submits any materials s/he wishes included.

If department wishes to provide input on the evaluation of part-time temporary faculty on annual appointments, it so informs the faculty member and the chair.

Two working days following the deadline for assembly of materials: Chair or responsible individual provides copy of the materials to be used as the basis for evaluation to the individual to be evaluated.

Seven working days following the deadline for assembly of materials: The faculty member may submit a rebuttal statement to any statement included in the materials to be used as the basis for evaluation.

March 10: Where the department TFEC is evaluating a faculty member, it provides a copy of its evaluation to the faculty member, with a copy to the chair & the dean.

Seven days following the issuance of the TFEC's evaluation: The faculty member may submit a rebuttal statement to the committee's evaluation, with copies to the chair, and the dean.

April 5: For full-time faculty on annual appointments, the dean provides a copy of his/her evaluation to the faculty member.

Seven days following the issuance of the chair's or dean's evaluation: The faculty member may submit a rebuttal statement to the dean's evaluation.

May 15: Completed evaluations for faculty on annual appointments are due to the Faculty Affairs Office for inclusion in the Personnel Action File. The individual who has completed the last level of review shall inform the faculty member that s/he has forwarded the evaluation for filing.

Part-Time Temporary Faculty

February 15: Chair or designee assembles materials to be used as the basis for evaluation. Faculty member submits any materials s/he wishes included.

If department wishes to provide input on the evaluation of part-time temporary faculty on annual appointments, it so informs the faculty member and the chair.

Two working days following the deadline for assembly of materials: Chair or responsible individual provides copy of the materials to be used as the basis for evaluation to the individual to be evaluated.

Seven working days following the deadline for assembly of materials: The faculty member may submit a rebuttal statement to any statement included in the materials to be used as the basis for evaluation.

April 5: For part-time faculty on annual appointments, the chair provides a copy of his/her evaluation to the faculty member, with copy to the dean.

Seven days following the issuance of the chair's or dean's evaluation: The faculty member may submit a rebuttal statement to the chair's evaluation.

May 1: For part-time faculty on annual appointments, in units with chairs, if the dean chooses to provide an evaluation, s/he provides a copy of his/her evaluation to the faculty member.

Seven days following the issuance of the dean's evaluation: The faculty member may submit a rebuttal statement to the dean's evaluation.

May 15: Completed evaluations for faculty on annual appointments are due to the Faculty Affairs Office for inclusion in the Personnel Action File. The individual who has completed the last level of review shall inform the faculty member that s/he has forwarded the evaluation for filing.

The complete wording of the campus criteria for the evaluation of temporary faculty can be found at:

http://www.sonoma.edu/UAffairs/policies/periodicpolicy.htm

Sonoma State University
Department of Chemistry
PEER OBSERVATION REPORT

Name of instructor being evaluated:

Course name and number:

Name of evaluator:

Date and time of classroom visit:

Number of student present/enrolled:

1) Topics discussed in class:

2) Please discuss the level of student participation:

3) Please discuss the teaching styles and methods observed:

4) Please discuss any problems which you feel could be improved:

5) Please discuss the utility of materials made available to the students:

6) Please discuss the utility of documents which clarify course goals and grading policies.

7) Please discuss the utility and methods used to evaluate students:

8) Please discuss laboratory protocols and directions (If applicable):

9) Please discuss the course strengths:

10) Please discuss the course weaknesses:

11) Specific recommendations for improvement:

Submitted by: Date:

I acknowledge that I have received and read a copy of this document and the original will be placed in my PAF in academic affairs.

Instructor: Date:

Chemistry

Chemistry
Supplemental Questions
for the
SSU Student Evaluation of Teacher Effectiveness
Please answer these questions as numbers 15 through 19

15. The course has increased my understanding of the subject.
16. The instructor writes examinations which covers the material in the course fairly.
17. I think the assignments were appropriate to learn the material.
18. Do you think your course grade will reflect the amount of knowledge you gained in this class?
19. I felt prepared for this class based on my pre-requite course work.

Free response

What did you like best and least about this course?
What influenced your performance in this class?
If you gave a low score please provide additional explanation or detail to help the instructor improve. Any additional comments?

Research Student Safety Policy

Students working in labs on research projects present a different safety concern compared to students participating in laboratory courses since the experiments and their outcomes are typically not as well defined. Moreover, students often work independently without the close supervision present in lab courses. These factors are inherent to laboratory research and cannot be avoided. It is the responsibility of each PI (principle investigator) to educate their research students on the safety issues associated with their work and to provide a safe working environment.

In an effort to be as safe as possible, it is essential for faculty, staff and students to be vigilant. Below are guidelines to assist faculty, staff and students in responding to potentially unsafe situations/conditions in the research labs.

1. In situations where there is an egregious breach in safety, faculty, staff or students should act quickly to stop the dangerous activity or give a warning of the imminent danger. Examples of this are:

   a. Activity that will likely lead to fire or explosion.
   b. Activity that can lead to a dangerous exposure to an acute toxin.
   c. Horseplay or inappropriate behavior that can lead to the bodily harm or destruction of lab equipment, instrumentation, etc.
   d. Improper transport of dangerous chemicals or compressed gases.

   In these cases, the dangerous activity should be reported to the PI as soon as possible so that appropriate corrective action can be taken. It is always preferable that the PI be the one to take action. If the PI is not immediately available, the faculty, staff or student should take action.

2. In situations where a faculty, staff or student thinks there may be a danger but is not sure and/or the danger is not imminent, the PI should be contacted to determine whether this situation is indeed dangerous. The department assumes that the PI is the most well-versed expert on the research activities and takes the appropriate responsibility for safety in their research lab. Examples of this are:

   a. Performing reactions outside the hood.
   b. Performing reactions with dangerous, possibly explosive reagents.
   c. Working with poisonous reagents.

   In these type of cases, the PI will decide whether the activity poses a danger and act accordingly. These decisions can be done in consultation with the Chemical Hygiene Officer (CHO) if needed.

3. In all cases where there is a perceived safety problem, the first and preferred course of action is to contact the PI. Again, the chemistry department expects that the PI has the greatest understanding of the safety concerns associated with their research activity and will act accordingly. In the event that the PI cannot be reached in a reasonable time and the problem is perceived to be acute (but not egregious), the CHO should be consulted.

4. In cases where there is a disagreement regarding safety, the Department will convene for discussion and resolution. If needed, a vote will be taken to decide the best policy or course of action.

Textbook Adoption Policy

Textbooks will be reviewed every 3 years. Any interested faculty can participate in review of the texts for individual courses (115, 125, 335, 105, 110, 102). Final discussion will take place at a dedicated department meeting followed by faculty voting (TT only) at the end. Spring 2012 will be the first review. See appendix for the schedule table.

Major Repeat Policy

Chemistry and Biochemistry majors may only repeat a total of 3 chemistry courses, any combination, for the major in order to graduate. Students can petition the department for reinstatement on a case-by-case basis.

Course Assignment Procedures

After three times through a course, the course becomes available for re-assignment. Faculty are not required to remain in a course for three full semesters.
Tenured/Tenure-track faculty get priority over adjunct faculty.
Courses that are available to be taught that more than one faculty want to teach go to lotto.
Faculty that haven’t taught a class in 3 years get priority for an available class.
After creation of the schedule, faculty will submit requests to the chair. In the requests, faculty should indicate if they are open to team teaching.
Elective Courses (1 per semester): Opportunities to teach an elective proceed in order of seniority (Carmen, Jenn, Su, Steve, Jon, Mark, Monica). Faculty can pass on their turn and maintain their place in line. Faculty may wish team teach with any of the other faculty they want. Once a faculty has taught an elective (alone or as part of a team), they go to the end of the line. TT faculty may also decide as a group to pause the schedule and allow a Visiting Professor with special expertise to teach the elective.
Adjuncts will be assigned courses last based on qualifications, performance, and past teaching history.
Faculty interested in teaching intersession should make their requests through the chair or the chair may request tenure track faculty to teach a course if there is a need.
See appendix for the schedule table.

POLICY: The Selection of Summer/Winter Session Instructors

There is often the need or desire to offer chemistry courses during the Summer and/or Winter session. Offering courses is dependent on a need for the course (adequate enrollment, student demands), adequate/available resources and a willingness and/or desire on the part of faculty to teach. Members of the chemistry department or other appropriate members of the academic community may request to teach courses during the Summer and/or Winter sessions and the following criteria will be used to select the instructors.

1. Priority will be given to tenure track faculty at SSU.

2. Teaching experience and competency in the course material will be considered. For example, instructors with superior teaching evaluations will be given priority.

3. The background of the instructor will be considered. For example, an advanced degree in Chemistry is preferred.

4. Priority will be given to those who have not had the opportunity to teach a Summer or Winter course recently (and have requested to do so).

The decision of who will teach the Summer and/or Winter session course and whether a course will be offered will be made by the Chair of the department in consultation with the permanent faculty.

POLICY: On General Chemistry
Sonoma State University Department of Chemistry

Challenging General Chemistry

1. Students who wish to challenge Chemistry 115A must take the ACS one-semester standardized exam. Students who score at or above the 70% (national ranking) will receive 4 units of credit for 115A.
2. Students who wish to challenge Chemistry 115B must take the ACS year-long short standardized exam. Students who score at or above the 70% (national ranking) will receive 4 units of credit for 115B.
3. In either case, students may only take the challenge exam one time. Students will coordinate the time and date to take the exam with the administrative coordinator for the chemistry department. If for any reason the student does not show up for their schedule appointment the department can deny another appointment.

Chemistry 125A/B

1. Completion of the full year of chemistry 125A and 125B will result in the following:
   - 10 units of credit for 125A and 125B
   - 4 units of credit for 255 upon completion of the "Challenge by Exam" form (per the instruction of Admissions and Records)
   - Waiving of additional Chemistry 255 requirement for majors and minors
   - Eligibility to enroll in Chemistry 335A concurrently with 125B upon consent of instructor
   - GE credit for categories B1 and B3 as well as the GE lab requirement
2. Completion of only 125A will result in the following:
   - 5 units of credit for 125A
   - Eligibility to enroll in 335A with instructor consent
   - GE credit for category B1 or B3 and the lab requirement
   - May take the challenge exam for Chemistry 115B and upon passing, receive an additional 4 units of general chemistry credit. See "Challenging General Chemistry" section above.
3. Failure to achieve a passing grade in 125A or 125B results in the following:
   - Eligible to re-start the general chemistry track with Chemistry 115A. Upon completion of 115A and 115B, the student can fill out a course repeat form to substitute the grade in 115B for the grade in 125A or 125B in order to have grade forgiveness.

ACS Exam

Instructors teaching CHEM 115B and CHEM 125B are responsible for administering the ACS 1-year general chemistry short exam and reporting their scores to the department chair and Academic Coordinator. Instructors are encouraged to treat the exam in a manner as such to encourage students to do their best.

Students repeating Chemistry 115A or 115B

Students repeating either general chemistry course should be identified and supplied with the "Course Repeat Policy." Instructors should stress to students that the policy will be enforced and they should have the form signed prior to final course registration. Students are required to repeat the course in its entirety which includes lecture, lab, and discussion.

Responsibilities in the laboratory including regards to chemicals, supplies, and student drawers

1. Instructors are responsible for dissemination of safety information and assignment of student drawers. The appropriate key number for obtaining a key will be provided to the instructor from the stockroom technician.
2. The stockroom technician will provide the instructor with the department approved student safety contract and a drawer inventory list. At the beginning of the semester instructors will oversee student check-in of

the drawers and will return the paperwork to the stockroom technician for filing. At the end of the semester, the instructor will oversee student check-out of the drawers to ensure a complete and clean set of glassware for the next semester.

3. In the event of glassware breakage during a lab section, instructors should send the student to the stockroom with a broken glassware slip for replacement. The stockroom technician will monitor glassware charges and ensure that glassware is replaced in a timely manner.
4. Students in either general chemistry course automatically fail the course if they miss more than 3 laboratory sections. This information should be included in the instructor's syllabus.
5. Instructors should choose labs from those core labs currently offered in the department. If they wish to introduce new labs these should be approved through the department;
6. The lab grade should count 20-25% of the total course grade in 115A and 115B.
7. Lab grading in 115A should include review of lab notebooks in some manner and lab grading in 115B should include lab reports.
8. The short year-long ACS exam for General Chemistry should be given in 115B and 125B.
9. The Chemistry Department Repeat Policy should be included in the course syllabus.
10. Textbook selection should follow the Chemistry Department textbook selection policy.
11. Students may perform a lab during a different section of the same week upon advance request of the instructor.
12. Instructors should provide the stockroom technician with a lab manual or list of required chemicals and equipment at least one week prior to the start of the semester. All necessary supplies for a lab section should be available in the lab at the start of the laboratory discussion period in quantities sufficient to ensure all students can complete the lab without running out of chemicals.

Chemistry topics for 115A and 115B

115A

1. states of matter; chemical vs physical changes
2. measurements and significant figures
3. scientific method
4. SI units
5. dimensional analysis
6. atomic theory and periodic table
7. molecular vs ionic compounds
8. nomenclature
9. chemical formulas and equations (including balancing chemical equations)
10. mass to mole conversions
11. stoichiometry and limiting regents
12. chemical reactions
13. molarity and dilutions
14. gas laws
15. first law of thermodynamics
16. quantum theory and electronic configuration
17. bonding theory and Lewis structures – MO and hybridization
18. geometry
19. states of matter

115B

1. properties of solutions – colligative properties and intermolecular forces
2. Rates of chemical reactions
3. reaction mechanisms
4. chemical equilibrium

    a. acid base reactions and buffers
    b. redox
    c. Ksp
    d. Complex ions
5. second law of thermodynamics (both the second and first could be covered in either or both classes.)
6. entropy and Gibbs free energy
7. electrochemistry

Optional topics for 115B:

1. main group chemistry
2. transition metal chemistry
3. organic chemistry
4. biochemistry
5. nuclear chemistry

Department of Chemistry Committee Charges and Organization

Curriculum Committee

The SSU Department of Chemistry Curriculum Committee is charged with vetting curriculum related issues for presentation to the department. These issues include, but are not limited to, scheduling, student petitions, degree patterns, and general curriculum development. The committee will present the results of their discussions to the department. The committee will be composed of three willing department members, by election of the core faculty if necessary. Terms will be for three years. Committee meetings are open to any who want to attend. Agendas will be sent out to faculty in advance and minutes will be kept on file in the department office.

Current Members: Suspended

Space and Equipment Committee

The SSU Department of Chemistry Space and Equipment committed is charged with overseeing department organization in terms of space, chemicals, equipment, and managing related budgets. Specific items monitored by this committee include prioritization of Nels' task list, proper use of lab fees and equipment maintenance budgets, and compliance with the chemical hygiene plan. The committee will present the results of their discussions to the department. The committee will be composed of three willing department members, by election of the core faculty if necessary. Terms will be for three years. Committee meetings are open to any who want to attend. Agendas will be sent out to faculty in advance and minutes will be kept on file in the department office.

Current Members: Suspended

RTP Committee

The SSU Department of Chemistry RTP committee is charged with creating appropriate documents for the RTP and sabbatical/DIP leave processes for tenure/tenure-track faculty members and for the evaluation of adjunct faculty in accordance with department and SSU policy. The committee is also charged with providing guidance and mentorship to tenure-track faculty as they progress towards tenure. In accordance with SSU policy, the committee will be composed of three tenured department members by election of the core faculty. Terms will be for one year.

Current Members: Carmen, Jon (Chair), Jenn (Fall 2014 – Fall 2015)

Department Leadership Positions:

Chemistry Club Advisor: Carmen Works, Monica Lares
Lead Academic Advisor: Carmen Works
Articulation Agreements Assessment: Steve Farmer (Jenn sub-Fall)
Catalog Updates: Mark Perri
CHO: Jon Fukuto
Radiation Safety Committee: Monica Lares
Professional Development Committee: Mark Perri
SI/Grader: Steve Farmer (Jenn sub-Fall)
Scholarships: Steve Farmer
Seminar Grant: Steve Farmer
Exit Exam: Steve Farmer
Webpage: Andrea Cullinen
School RTP: Meng-Chih
Department Moodle Page- Monica and Andrea
Stockroom Search Committee: Jenn, Mark, Jon
Instrument Tech Oversight: Jon

Internal Review of the Chemistry Department Chair

Each three year term the department chair is reviewed internally by the department. This serves to deliver constructive and clear feedback so that the chair can continue to operate in the department's best interest. These include, but are not limited to, developing clear guidelines for the chair to continue to move forward in a constructive manner, develop and initiate new programs, maintain a healthy department. All members of the department (faculty, adjunct faculty, staff and students) are encouraged to participate and a tenured member of the faculty will spearhead the process. The leader(s) of this process will collect and consolidate this material and present it to the chair in an outline form. This will ensure confidentiality, honesty, and priorities (if an issue is presented by many members of the dept).

This process will start after one-year of the three year term. To start this process the department should meet and develop clear expectations of the chair. These expectations should be incorporated into this document to create a dynamic process for the entire department.

Once this process has occurred each member of the department should fill out the questionnaire and write a constructive paragraph to one page document about the progression of the chair-ship. These will be delivered to the faculty member(s) leading the process to be consolidated.

Finally the chair will meet with the leader of the review committee to discuss their progress and direction.

Expectations of the department chair in chemistry at SSU

1. Attend weekly chair meetings
2. Coordinate department meetings
3. Assure that faculty members (tenure-tenure-track, and adjust) are developing professionally and receiving mentorship
4. Advocate for the department to the Dean and upper levels of administration
5. Works with members of the faculty on issues of retention
6. Have regular meetings with staff members
7. Manage the department budget
8. Facilitate department duties – retreats, plans, organization, delegation, RTP, CHO, CH plan
9. Attend yearly CSU chemistry chair meetings.

Internal Chair Review Questionnaire

All members of the department:

1. The chair respects my point of view

1 2 3 4 5

Agree strongly disagree

2. The chair listens to my ideas and concerns

1 2 3 4 5

Agree strongly disagree

3. The chair has a reasonable expectation of the development of the department

1 2 3 4 5

Agree strongly disagree

4. The chair advocates for the department and the members of the department

1 2 3 4 5

Agree strongly disagree

5. The chair recognizes the relationship of the department to the school, university and the other CSUs

1 2 3 4 5

Agree strongly disagree

6. The chair allows for me to feel included in department affairs, to the extent that I am comfortable

1 2 3 4 5

Agree strongly disagree

7. The chair is aware of workload issues and protects me from overload

1 2 3 4 5

Agree strongly disagree

8. I feel that the chair informs me of important matters that are developing at the chair's meeting

1 2 3 4 5

Agree strongly disagree

9. The chair effectively manages the department OE and makes spending issues transparent

1 2 3 4 5

Agree strongly disagree

10. The chair make sure that the department completes projects

1 2 3 4 5

Agree strongly disagree

Lectures and Tenure, Tenure-Track Faculty:

11. The chair helps faculty members to develop in the area of scholarship, teaching and professional development

1 2 3 4 5

Agree strongly disagree

12. The chair helps junior faculty develop a reasonable plan towards retention, tenure and promotion in collaboration with the department RTP committee

1 2 3 4 5

Agree strongly disagree

Please comment on the chairs strengths:

Please comment areas that could be improved:

Please provide other comments:

A. Schedule for textbook adoption

CHEM	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
115 AB	X				
125 AB	X				
335 AB			X		
102					X
105		X			
110		X			
255	X				
all other (445/446, 310 AB, 325)				X	

B. Schedule for course elective offerings

	Spring2012	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015
Carm	pass	Bioinorganic				Bioinorganic	
Jenn	pass		BactPath				up3
Steve	PharmANDSyn						up4
Su				pass			up1
Jon	PharmANDSyn			ChemBio			
Mark					Atmospheric		
Monica						pass	up2

Proposal 1:

9 WTU Direct Contact Teaching Load in Chemistry 3 WTU for Scholarship

Current Need

7 faculty, 3 WTU/semester = 42 WTU/academic year

Expectations

- In order to receive 3 WTU towards mentoring undergraduate research students, a faculty member must be mentoring a minimum of 3 students. If inactive faculty become active, they receive the first 3WTU scholarship release in the spring of the year they become active.
- Active faculty continue to require students to present their work.
- 48 unit total leaves room for support of inactive faculty should their status change.
- This distribution would be revisited in the extent of a new hire.

Chemistry Department Contribution

- Revision of Curriculum in 2012 to incorporate all new research students into one course series (CHEM 315/316) instead of individual contract courses:

  CHEM 315/316: 5 WTU total (2 in fall, 3 in spring)

    Average CHEM 315/316 enrollment over last two years: 27 students

    WTU cost for 27 students in CHEM 494: 9 WTU/semester = 18 WTU

    Difference: 18 – 5 = 13 WTU

- Faculty currently not mentoring at least 3 undergraduates = 1: 6 WTU

- Faculty teaching 315/316 receive 1 WTU to reach 6 for the year: 5 WTU

- Faculty rotation out 3 undergraduates = 1: 6 WTU

TOTAL: 30 WTU

Dean's Office Contribution

Chemistry currently has 12 WTU of adjunct support release to ES. We keep those 12 WTU and they become dedicated to support scholarship in our department as opposed to ES.

TOTAL: 12 WTU

Proposal 2:

9 WTU Direct Contact Teaching Load in Chemistry 3 WTU for Scholarship

Current Need

7 faculty, 3 WTU/semester = 42 WTU/academic year

Expectations

- In order to receive 3 WTU towards mentoring undergraduate research students, a faculty member must be mentoring a minimum of 3 students. If inactive faculty become active, they receive the first 3WTU scholarship release in the spring of the year they become active.
- Active faculty continue to require students to present their work.
- 49 unit total leaves room for support of inactive faculty should their status change.
- This distribution would be revisited in the extent of a new hire.

Chemistry Department Contribution

- Revision of Curriculum in 2012 to incorporate all new research students into one course series (CHEM 315/316) instead of individual contract courses:

  CHEM 315/316: 5 WTU total (2 in fall, 3 in spring)

  Average CHEM 315/316 enrollment over last two years and predicted third: 29 students

  WTU cost for 27 students in CHEM 494: 9.7 WTU/semester = 19 WTU

  Difference: 19 – 5 = 14 WTU

- Faculty currently not mentoring at least 3 undergraduates = 1: 6 WTU

- Faculty teaching 315/316 receive 1 WTU to reach 6 for the year: 5 WTU

- Department chair receives 1 WTU/semester for scholarship. 4 WTU

- Condense discussion sections for 336A into one/semester. Typically offer 4 and 2 sections in fall and spring, respectively, = 6 WTU. Difference = 4 WTU.

- Condense discussion sections for 336B into one and only offer in spring. Typically offer 1 section each semester = 2 WTU. Difference = 1 WTU.

  <u>TOTAL: 37 WTU</u>

Dean's Office Contribution

Chemistry currently has 12 WTU of adjunct support release to ES. We keep those 12 WTU and they become dedicated to support scholarship in our department as opposed to ES.

<u>TOTAL: 12 WTU</u>

Appendix M

External Review for this program review