FERRIS STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

TO: Matt Wagenheim, Chair, Academic Program Review Council (APRC)
CC: David Frank, Department Head, Physical Sciences
Kim Colvert, Chair, Program Review Panel and Biochemistry Program Coordinator
Dan Adsmond, Chemistry Program Coordinator
FROM: Joseph Lipar, Interim Assistant Dean, College of Arts and Sciences
RE: Chemistry B.A. & Biochemistry B.A.
DATE: 09/04/2015

The Chemistry B.A. and Biochemistry B.A. programs, which are housed in the Department of Physical Sciences, have been reviewed in a single document. The program review committee has done a good job of highlighting the shared success of the programs while also pointing out the differences between them. In addition to the development of chemical and biochemical skills and knowledge in their students, both programs additionally focus on the development of scientific literacy, communication skills, problem solving skills, and the ability to work as part of a team. Also, because both programs are B.A. programs, students have additional opportunities to enhance their communication and foreign language skills. The faculty involved with these programs are active members of the campus community and truly care about the success of their students. Many of the chemistry courses that are outlined in this review also serve as program courses for a variety of programs from across the campus; the support of the department and its faculty in supporting those programs is incredibly important to the success of the students in those programs.

The review document outlines a well-defined strategic plan for improvement of the program. Some aspects of this strategic plan have been addressed, while others still require attention. The committee has identified these areas and provided a plan for future efforts. Both programs also have well-defined student learning outcomes, and the review document provides examples of how course content has been adjusted based on assessment data related to those outcomes. The review document also provides a comparison between these programs and those found at nearby institutions, while highlighting the advantages of the programs here.

I would agree with the conclusions of the review committee that the following areas could use some improvement and/or attention: 1) enrollment in the programs could be increased, perhaps through increased marketing of the program and increased recruitment efforts, 2) greater connections with alumni and with potential employers could be made; this would increase the visibility of the program, provide internship and job opportunities for students, and provide potential opportunities for donations, and 3) assessment of course-level and program-level outcomes could be expanded.

The dean's office feels that these are valuable programs that benefit the students at our university.

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Chemistry & Biochemistry BA Report for the Academic Program Review Committee 2015

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1. Program Name and History

Chemistry BA and Biochemistry BA

The Chemistry and Biochemistry BA degrees provide backgrounds for a wide variety of careers in science or in science-related fields, some involving further education. These include but are not limited to careers in chemistry, biochemistry, medicine, dentistry, education, environmental science, forensic science, pharmaceutical sales, and scientific writing. The BA degrees stress breadth with fewer required chemistry courses than a BS degree with the goal of producing scientists having more well-rounded backgrounds and stronger language and communication skills. The 120 credit hours of the Chemistry BA (122 credits for the Biochemistry BA) include the Chemistry (or Biochemistry) major, the BA core, an academic minor in another field of study, and all general education requirements for the Bachelor of Arts degree.

Although the Chemistry and Biochemistry BA degrees have been in existence for only 11 years, a majority of the chemistry courses in these programs have been taught at Ferris for much longer and were originally designed to support programs other than the Chemistry and Biochemistry BA degrees. The Industrial Chemistry Technology (ICT) Associates degree has a 55-year history at Ferris and 27 credits of the chemistry courses in the Chemistry BA degree were previously included in the ICT degree. One of these courses, Instrumental Analysis (Chem 317) because it was designed for the ICT degree is taught in a very practical hands-on manner and is considerably less theoretical in nature than a standard Instrumental Analysis course in a Bachelors program. Other advanced courses included in these two BA degrees were previously in existence in support of the Chemistry Education BS and the Biotechnology BS degrees.

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2. Program Mission

FSU mission statement.

> Ferris State University prepares students for successful careers, responsible citizenship, and lifelong learning. Through its many partnerships and its career-oriented, broad-based education, Ferris serves our rapidly changing global economy and society.

College mission statement.

> Through academic programs, general education, and outreach activities, the College of Arts and Sciences provides a learning-centered education that prepares students to contribute to a complex and diverse world.

Departmental Mission Statement.

> The department of Physical Sciences provides students with the opportunity to acquire the knowledge and skills needed to be successful in their science-related careers and regardless of career path, to be scientifically literate citizens.

Program mission statement.

> The mission of the Chemistry and Biochemistry BA programs is to provide students with the chemical/biochemical knowledge and laboratory skills as well as the critical thinking, communication, and teamwork skills necessary to be successful in a chemical/biochemical or science-related career.

Incorporating the Mission.

The program mission aligns strongly with University mission statement in that it focuses on preparing students for successful careers in Chemistry and Biochemistry as well as giving the students the critical thinking, communication, and teamwork skills needed to be responsible citizens in our global society or as stated in the college mission statement, "to contribute to a complex and diverse world." The connection to the departmental mission statement is necessarily more direct. Both the program and department statements focus on providing the knowledge and skills needed for success in science-related careers. In Section 3 on Program Goals we more specifically show how our goals fit within the department and college planning goals.

The ideas expressed in the program mission statement are the primary motivators in curricular changes that we make in the Chemistry and Biochemistry programs. During the 11 years of the existence of these programs we have invested considerable time and energy into curricular reforms that address the critical thinking, communication and teamwork skills that employers look for in potential employees. We engage our students in collaborative research projects in the laboratory where they critically evaluate the data that they collect, draw conclusions, present their findings to their peers, and critique each other's work. In the lecture setting students engage in various forms of group problem solving as well as presenting and discussing the scientific literature at the upper level. Ongoing discussions in the department about the success and failure of various pedagogical methods center on the major points of the mission statement. These

discussions are also stimulated by the regular participation of members of the department in the Biennial Conference on Chemical Education, a national meeting where the latest research in chemical education, ideas, and methods are presented and discussed. Several faculty members have regularly given of their time in the supervision of extended independent student research projects. This experience, especially if it results in a presentation at a technical conference, becomes a capstone experience in the student's career-oriented education and provides a model for life-long learning.

We constantly communicate to the students the importance of developing the skills we have listed in the program mission statement. This is done verbally, through syllabi and through assignments. Students in turn demonstrate these skills to potential employers, often surprising them with their ability to explain in detail how various instrumental techniques can be used in problem solving as they describe the research they have been involved in.

3. Program Goals

The mission of the Chemistry and Biochemistry BA programs is fleshed out in the educational goals for both programs as listed below. These goals were established by a committee of chemistry faculty and the Physical Sciences department head, and were reviewed by the other chemistry faculty. No changes in the goals have been needed since the last program review.

1) Goals

Upon graduation Chemistry BA students should be able to:

- Demonstrate working knowledge of inorganic, organic, analytical, and physical chemistry.
- Apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills.
- Critically evaluate the work of others and cooperate to solve problems.
- Work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.
- Perform accurate and precise quantitative measurements and perform statistical analyses of resultant data to assess reliability of results.
- Effectively communicate and present technical information in a clear, concise, scientifically appropriate manner in a variety of formats.

Upon graduation Biochemistry BA students should be able to:

- Demonstrate working knowledge of inorganic, organic, analytical, and physical chemistry.
- Demonstrate the basic knowledge of biology topics supporting their understanding of chemistry.
- Articulate the relationship between chemistry and the biological sciences.
- Apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills.
- Critically evaluate the work of others and cooperate to solve problems.
- Demonstrate the skills to work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.
- Demonstrate mastery of basic biochemical laboratory techniques and theories associated with analysis/manipulation of biomolecules.
- Recognize the value of effective communication and present technical information in a clear, concise, scientifically appropriate manner in a variety of formats.

- Retrieve and use peer-reviewed scientific literature and evaluate technical articles critically.

These educational goals are realized through a carefully developed, implemented, and assessed educational process that is supported by the following 4 pillars:

1) A process by which learning is assessed.
2) Appropriate course and program offerings.
3) Well maintained up-to-date equipment and learning spaces.
4) A faculty that is up-to-date on current pedagogical and scientific developments.

Consequently, our broader strategic planning goals in support of our educational goals are to:

1) Use course and program assessment data to improve student learning.
2) Continuously evaluate course offerings as well as the need for additional program offerings.
3) Maintain and upgrade the chemistry labs, equipment, and instrumentation.
4) Support faculty development.

Employers tell us that they want graduates who can communicate effectively, solve problems, and work as part of a team. These skills are an integral part of the mission of the Chemistry and Biochemistry BA programs and are emphasized in various courses throughout the BA curriculum.

The four broader program goals closely parallel the four strategic planning goals of the Physical Sciences Department and strongly support College of Arts and Sciences Strategic Planning Goal 3 which is to "Become a demonstrable center of excellence in educational quality, student engagement, and student learning."

The Chemistry and Biochemistry BA program goals also relate very strongly to the mission of the University, which is to prepare students for successful careers, responsible citizenship, and lifelong learning. It is the goal of the Chemistry and Biochemistry BA programs to prepare students for *successful careers* in chemistry or in science-related fields. The programs emphases on teamwork and communication provides students with skills required for *responsible citizenship* and the emphasis on critical thinking helps prepare the student for a *lifetime of effective learning*.

Specific program goals are emphasized to varying degrees in the course goals of each of the chemistry courses that our students take. Individual faculty focus on the goals most closely associated with the courses that they teach and communicate those goals to the students through their syllabi and course assignments.

The Following is an outline of the Strategic Plan for the Chemistry and Biochemistry BA programs. Each action step is identified as a short-term (ST) often one time step or a long-term (LT) often ongoing step.

Program Goal #1: Use program assessment data to improve student learning.

Desired Outcome: Assessments demonstrate that student learning is improving.

Action Steps:

A. Develop program outcomes and assessment plan.
   i) Delineate program outcomes. (ST)
   ii) Develop curriculum map aligning program and course outcomes. (ST)
   iii) Develop assessment plan. (ST)
   iv) Implement assessment plan. (LT)
   v) Develop 5 and 10 year plan for programs based on historical numbers of students in each program and where students go after FSU. (LT)
B. Design and implement an alumni tracking protocol.
   i) Locate alumni. (ST)
   ii) Develop strategy for obtaining contact info before graduation. (ST)
   iii) Create a department newsletter. (ST)
   iv) Develop a survey to obtain employer information and program assessment data. (ST)

Program Goal #2: Continuously evaluate program offerings.

Desired Outcome: Strengthen programs and broaden options for all students.

Action Steps:

A. Examine course needs for upper-level majors
   i) Develop alumni/employer survey (ST) and use resultant data (LT)
   ii) Examine peer programs for upper-level courses. (ST)
B. Identify internship/research opportunities for students
   i) Contact alumni, employers, graduate schools (ST)
   ii) Examine and collate internship postings by established laboratories (LT)
   iii) Encourage program students to attend presentations by former students and other personnel from industry (LT)
   iv) Coordinate efforts with the CAS development officer. (LT)

Program Goal #3: Maintain and upgrade learning spaces and equipment.

Desired Outcome: Improve student learning experiences through up-to-date equipment and facilities.

Action Steps:

A. Assess and prioritize needs for laboratory spaces.
   i) Survey departmental faculty for needs. (LT)
B. Assess and prioritize needs for classroom spaces.

i) Survey department faculty for needs. (LT)

C. Assess and prioritize needs for "big-ticket" equipment items.
   i) For each area, identify and prioritize the current and near term needs for maintenance, replacement or addition of equipment. (LT)
   ii) Identify and pursue funding outside the department. (LT)
   iii) Coordinate funding efforts with the CAS development officer. (LT)
   iv) Work with program alumni to increase their awareness of our needs. (LT)

Program Goal #4: Support faculty development.

Desired Outcome: Maintain a high quality knowledge base for departmental faculty.

Action Steps:

A. Support and encourage travel to professional conferences.
   i) Identify barriers to professional development and travel. (ST)
   ii) Produce annual report of who traveled, why, and the cost of travel. (LT)
B. Recruit excellent faculty and mentor them when hired.
   i) Search committees identify best faculty candidates. (ST)
   ii) Mentors identified for new faculty. (ST)
   iii) Regular feedback from mentors, tenure committees and department head. (LT)
C. Increase interaction and collaboration between program faculty.
   i) Assess interest in beginning a science colloquium series and/or discussion group. (ST)
   ii) Collaborate with FCTL to offer ad hoc discussion groups of scientific interest. (LT)

Goal Attainment (progress and future plans)

Goal #1 Use program assessment data to improve student learning. Significant progress has been made in delineating program outcomes, developing curriculum maps, and implementing assessment plans. During the past 5 years we have collected a variety of data on student learning from a range of courses and have entered the data into TracDat. The data includes national percentile performances of our students on American Chemical Society exams, item analysis on specific types of exam questions, scores on laboratory reports and other writing assignments, and performance on oral presentations of various types. The data is informing ongoing discussions on teaching methods and their relationship to student performance in our various assessments. Creation of a departmental newsletter and developing a more effective strategy for maintaining contact with alumni are important action steps that still need to be taken. Now that the programs have been in place for 11 years and we have a better sense of the various directions are graduates are going we are beginning to discuss what long term planning goals might most closely meet the needs of our students.

Goal #2 Continuously evaluate program offerings. We continue to evaluate our course offerings and the frequency of their offering. Because of increased enrollment we now offer Physical Chemistry annually which was previously offered only in alternate years. Inorganic Chemistry, which began as an experimental course, is now offered every Spring of even numbered years. We also continually evaluate our summer offerings. We have developed stakeholder surveys and have examined the resultant data. The lack of employer data is a reflection of the need for a stronger connection between Ferris and the employers, a goal to be pursued in the near future. When alumni and other industry representatives visit Ferris their talks and informal discussion sessions with students are well attended. Greater efforts can be made in posting internship opportunities.

Goal #3 Maintain and upgrade learning spaces and equipment. Due to budgetary limitations this is the most challenging of our goals. We prioritize our needs and typically address those that are most urgent. We lack the funding to replace aging instruments and lack the personnel needed for instrument maintenance. On the bright side we have been provided with funds to purchase a mass spectrometer which has given the students valuable hands on experience and soon will have access to the instrumentation in the new Shimadzu core facility. Faculty are periodically surveyed for lecture, laboratory, and big ticket needs. An increased effort needs to be made to communicate our needs to our alumni, to their employers, and to funding agencies.

Goal #4 Support faculty development. We have an active faculty development committee that oversees the expenditure of faculty development monies and facilitates the sharing of knowledge gained by faculty. Our faculty development committee has facilitated ongoing faculty discussions on the most effective use of the funds available to us. Over the past two years we have developed and are testing a new system where faculty members are provided with larger blocks of funding in alternate years in order to provide opportunities for them to benefit from more costly development opportunities. Our faculty have used the funds over the past 5 years for a wide variety of professional development activities including conference and workshop participation. Faculty discussion groups are not currently being initiated by any of the program faculty.

Looking forward, we plan to continue collecting and reflecting upon the data we gather on our students' learning and will determine whether specific curricular changes are warranted. We will continue to evaluate our course offerings and make adjustments when necessary. We will continue to make the best use of funds available to us for equipment/instrument maintenance and upgrades and plan to highlight our specific unfunded needs for instrument upgrades and personnel for maintaining our current instruments. Our new system for distributing faculty development funds will be evaluated and changes will be made as appropriate. We will continue to determine and utilize the most effective ways of remaining current in our science and pedagogy.

4. Curriculum

Program Check Sheets—See Appendix I
Course Syllabi—See Appendix II

The Chemistry and Biochemistry BA programs were developed to optimize the resources available in the Physical Sciences Department while serving the needs of the University to generate more Bachelor Degree programs. Changes to the program content are largely dependent on the feasibility, based on those resources, of adding new courses. Such changes are usually initiated by individual faculty and overseen by the departmental curriculum committee. As an example, the need for an upper level Inorganic Chemistry course, based on the common knowledge of typical chemistry programs, was proposed by individual faculty, offered on a trial basis and eventually CHEM 381 Inorganic Chemistry was approved and added to the departmental offerings. It was immediately incorporated as one of the upper level course options in the Chemistry BA program. Such opportunities for expansion are rare but when resources permit there is a long-standing waiting list of typical chemistry courses that could be added that would enhance the degree.

The departmental curriculum committee has also overseen minor course numbering and prerequisite adjustments that reconcile inconsistencies in official university documents. The most significant change in this area has been to place grade requirements on prerequisite classes. The theory is that such restrictions send a clear message to the student that continuing in a sequence requires a successful completion of the earlier courses. As of yet no measurable difference has been discerned.

Courses should evolve with time but such evolution does not always change the scope and description that define the course. The responsibility for individual course content lies with the teaching faculty. Changes that do not require formal action are implemented at the discretion of the instructor based on their classroom experiences. If assessment tools, student feedback or other indicators were to suggest a need to alter the official defining properties of a course such changes would be made through the normal curricular process. When a course is taught by more than one faculty member a committee of those involved would determine the need for change and the actions to be taken.

Dissemination of program and general education requirements occurs by several methods. Requirements are published on-line and available from a number of University offices. The program coordinators regularly participate in recruiting events that offer the opportunity to distribute and discuss program requirements. The bulk of this task falls to the program coordinators. Vigorous advising by program coordinators keeps current students on track toward graduation and aware of other educational opportunities such as in-house research, summer research programs for undergraduates, conferences, community outreach opportunities and so on. While not required these experiences are encouraged and supported by the faculty and greatly aided by the Ferris student chapter of the American Chemical Society.

5. Assessment

Chemistry BA Degree:

Student Learning Outcomes

1) Working Knowledge: Students should demonstrate a working knowledge of inorganic, organic, analytical, and physical chemistry

2) Apply Understanding: Students should apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills.

3) Critically Evaluate: Students should critically evaluate the work of others and cooperate to solve problems.

4) Lab Skills: Students should work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.

5) Accurate Measurements: Students should perform accurate and precise quantitative measurements and perform statistical analyses on resultant data to assess reliability of results.

6) Effective Communication: Students should effectively communicate and present technical information in a clear, concise, scientifically appropriate manner in a variety of formats.

We have current assessment results for the first, second and sixth outcomes. (See Appendix III)

We have assessed students' working knowledge of the different chemistry disciplines using national standardized final exams prepared by the ACS (American Chemical Society.) We have administered the second semester general chemistry exam ACS exam in CHEM 122, the yearlong organic chemistry ACS exam in CHEM 322, and the thermodynamics ACS exam in the Physical Chemistry course (CHEM 451.) Our current criterion for success on these exams is that FSU students will score at least as high as the 50th percentile nationwide, (i.e. Ferris students will score at or above the national average.)

Our criterion for success in the general chemistry exam has changed over the years. In previous years we had arbitrarily chosen that students score 65% correct or above on these exams. Furthermore, it led to an appearance that we had set a low standard of performance, when such was not the case. The ACS exams are formulated such that someone scoring in the 99th percentile may have answered only 75–80% of the questions correctly. After some discussion within the general chemistry assessment committee, we decided to set a more realistic standard that Ferris students would achieve at or above the national norm for each of the outcomes.

In CHEM 122, students averaged at the 59th percentile nationally in Spring 2014, and the 67th percentile nationally in Spring 2015. For unknown reasons, there is more fluctuation in the

organic chemistry results from CHEM 322. In spring of 2012 and spring of 2011, students averaged at the 64th percentile nationally. However, in Spring 2014 and Spring 2015 the average was 32th percentile nationally. In Spring of 2009, CHEM 451 students scored at the 65th percentile nationally on the ACS thermodynamics exam. Overall we are pleased with our students' performance on these ACS exams as compared to the national average. These results assure us that our content is thorough and rigorous.

Members of the general chemistry group have examined the ACS scores in relation to the outcomes for the general chemistry course. The thermochemistry outcome (related to heat and energy,) was deemed especially important by the committee, in part because it is crucial to understanding material taught in the upper level Physical Chemistry course (CHEM 451.) This outcome had particularly low scores, so faculty teaching the course decided to put additional emphasis on that outcome.

We have assessed students' ability to apply understanding by selecting 20 questions from the ACS exams which require application cognitive skill level of Bloom's technology. The average score on these questions in Spring 2011 was 66%, and the average in Spring 2012 was 62%. These averages are just below the criterion for success of above 70%.

We have assessed students' ability to effectively communicate with student performance on a distillation formal lab report in CHEM 321. The averages score over 3 semesters (Fall 2011, Fall 2012, and Fall 2013) was above 80%. This performance met our expectations for this outcome.

Program-Chemistry(B.A.)-Curriculum Map

Legend: (A)-Program Assessment, (I)-Introduced, (M)-Mastery, (R)-Reinforced

Outcomes	CHEM 121	CHEM 122	CHEM 231	CHEM 317	CHEM 321	CHEM 322	CHEM 332	CHEM 364	CHEM 451	MATH 220	PHYS 211	PHYS 212
Working Knowledge-Students should demonstrate a working knowledge of inorganic, organic, and physical chemistry	I	A	A		I	A			A			
Apply Understanding-Students should be able to apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems using formal and concrete thinking skills								I	A			
Critically Evaluate-Students should know how to critically evaluate the work of others and cooperate to solve problems				I			I		A			
Lab Skills-Students should demonstrate the skills to work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.	I	R	I	R	A	A	R					
Accurate Measurements-Students should perform accurate and precise quantitative measurements and perform statistical analyses on resultant data to assess reliability of results.	I	I	R	R			R					
Effective Communication-Students should recognize the value of effective communication and present technical information in a clear, concise, scientifically appropriate manner in a variety of formats			I	R		R			A			

Biochemistry BA Degree:

Student Learning Outcomes

1) Working Knowledge: Students should demonstrate a working knowledge of inorganic, organic and physical chemistry.

2) Basic Knowledge: Students should demonstrate the basic knowledge of biology topics supporting their understanding of biochemistry.

3) Relationship: Students should articulate the relationship between chemistry and the biological sciences.

4) Apply Understanding: Students should be able to apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills.
5) Critically Evaluate: Students should know how to critically evaluate the work of others and cooperate to solve problems.

6) Lab Skills: Students should demonstrate the skills to work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.

7) Biochemical Lab: Students should demonstrate mastery of basic biochemical laboratory techniques and theories associated with analysis/ manipulation of biomolecules.

8) Effective Communication: Students should recognize the value of effective communication and be able to present technical information in a clear, concise, scientifically appropriate manner in a variety of formats.

9) Scientific Literature: Students should be able to retrieve and use peer-reviewed scientific literature and evaluate technical articles critically.

We have current assessment results for the first, third, fourth, seventh, eighth and ninth outcomes. Each of our results, except those for the first outcome, met the criterion for success (which is a score of 65 % or above.)

Part of the assessment for the first outcome, working knowledge, used the ACS exams previously discussed. We used the second semester general chemistry ACS exam in CHEM 122 to assess working knowledge of inorganic chemistry, and the year-long organic chemistry ACS exam in CHEM 322 to assess working knowledge of organic chemistry. The assessment results from these exams have been previously discussed.

We used performance in CHEM 474, Advanced Biochemistry, to assess the third, fourth, eighth, and ninth outcomes. Assessment methods include exams, a current research paper, and class presentation of a research paper.

The average of all exam scores in CHEM 474 in Spring 2014 was 79.8% , and the average in Spring 2015 was 76.6%. These results suggest that students are able to apply their understanding to analyze and solve problems, (outcome number 4.) Students ability to retrieve information and use scientific literature (outcome number 9,) was assessed using a paper focused on current research. The average score on this paper was 90.9% in Spring 2014 and 80.0% in Spring 2015, both meeting the criteria for success. Effective communication skills (outcome number eight,) was assessed using a singles research paper that was presented to the class and evaluated by a rubric. The class average in Spring 2014 was 84.5%, and the class average in Spring 2015 was 83.0%.

Performance on formal lab reports in CHEM 333, Biochemistry Lab 2, was used to assess outcomes number seven. Specifically, the procedure and discussion sections of a late-semester laboratory exercise was scored according to a rubric. The average score on the procedure section in Spring 2013 was 80.7%, and the average in Spring 2014 was 85.3%. The average score on the discussion section in Spring 2013 was 77.2%, and the average in Spring 2014 was 73.5%.

Assessment in biochemistry has been challenging. We had hoped to develop an in-house exit exam to be given to students in their senior year to assess students' basic knowledge of biology (outcome number 2,) students' ability to articulate relationship between biology and chemistry (outcome number 3,) students' ability to apply understanding, (outcome number 4,) and students' laboratory skills and ability to apply the scientific method, (outcome number 7.) None of the students met the criterion for success on the two different versions of a pilot exit exam. Part of the difficulty is that the sample size is too small to generate meaningful data. In one year two biochemistry majors took the exam, and in another year four majors took the exam. Alternate methods of assessment are currently being discussed.

Program-Biochemistry(B.A.)-Curriculum Map

Legend: (A)-Program Assessment, (I)-Introduced, (M)-Mastery, (R)-Reinforced

Outcomes	BIOL 121	BIOL 122	BIOL 375	CHEM 121	CHEM 122	CHEM 321	CHEM 322	CHEM 332	CHEM 333	CHEM 364	CHEM 451	CHEM 474	MATH 220	PHYS 211	PHYS 212
Working Knowledge-Students should demonstrate a working knowledge of inorganic, organic, and physical chemistry				I	A	I	A	I	A	R	R	R			
Basic Knowledge-Students should demonstrate the basic knowledge of biology topics supporting their understanding of biochemistry	I	R	R									A			
Relationship-Students should articulate the relationship between chemistry and the biological sciences										I		A			
Apply Understanding-Students should be able to apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems using formal and concrete thinking skills										I	R	A			
Critically Evaluate-Students should know how to critically evaluate the work of others and cooperate to solve problems								I	R			A			
Lab Skills-Students should demonstrate the skills to work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data.				I	R	A	A	R	R						
Biochemical Lab-Students should demonstrate mastery of basic biochemical laboratory techniques and theories associated with analysis/manipulation of biomolecules							I	A,R							
Effective Communication-Students should recognize the value of effective communication and be able to present technical information in a clear, concise, scientifically appropriate manner in a variety of formats								I	R			A,R			
Scientific Literature-Students should be able to retrieve and use peer-reviewed scientific literature and evaluate technical articles critically								I	R			A			

6. Program Profile

Apps, Admits, and Enrolled

Applications and Admission

There is no application process for the Chemistry and Biochemistry BA programs. Students who are admitted into the university and are interested in one of these two degrees are admitted into the program and enrolled into appropriate courses based on the students' educational background. The following table reports the enrollment in these two programs over the 5 years from 2009-2013.

Chemistry BA Enrollment 2009-2013

Year	Freshmen	Sophomores	Juniors	Seniors
2009	4	0	8	16
2010	7	8	7	15
2011	6	5	10	11
2012	4	6	7	16
2013	0	4	7	15
5 Year Average	4	5	8	15

Biochemistry BA Enrollment 2009-2013

Year	Freshmen	Sophomores	Juniors	Seniors
2009	1	1	3	5
2010	2	1	2	2
2011	7	0	3	4
2012	0	1	2	6
2013	0	0	2	4
5 Year Average	2	1	2	4

The enrollment trends for the 5 year period examined are fairly constant. At any given time we have approximately 30 students enrolled in the Chemistry program and 10 students enrolled in the Biochemistry program. A majority of students enroll in the program after their sophomore year. All students are on-campus (none are off-campus or online)

The ideal number of enrolled students given present limitations is between our current numbers and 50% higher than our current numbers. Our Quantitative Analysis course, Instrumental Analysis Lab, and upper level Biochemistry courses are near their enrollment limits. Additional sections would need to be opened if program enrollments increased significantly. Secondly, one of the highest impact practices in the education of a Bachelors level chemist or biochemist is the

independent research project. Students who have demonstrated the ability to work independently in the laboratory setting are sought out by employers as are students who have presented their research results at professional meetings. Under current conditions the opportunity for any of our students at Ferris to have an independent research experience rests on the willingness of a faculty member to devote his/her time without compensation. Mentoring a research student is a time intensive endeavor and most faculty are unable to donate the time required above their full load of 16 contact hours. Consequently accepting additional students into our programs would result in a greater percentage of our students graduating without this valuable capstone experience.

Currently a majority of our graduates did not enroll in a Chemistry or Biochemistry program as freshmen. Instead they have typically switched to Chemistry or Biochemistry after completing 10-24 credits of Chemistry courses in pursuit of a different degree. It is unlikely that large numbers of students will be attracted to Ferris to enroll in our Chemistry or Biochemistry programs without an American Chemical Society approved BS program and the benefits it would provide. ACS approval would require 2-3 additional chemistry courses, significant reduction in teaching loads, reassigned time for student research supervision, and a significant increase in support for instrument maintenance and updating. All new faculty hires would need to engage in research with students.

Enrollment – Residency

Biochemistry Enrollment by Residency, Age, FSU GPA, and ACT

Year	Residents	Non-Residents	Av. Age	Av. GPA	Av ACT
2010	5	2	21	2.65	28
2011	12	2	20	2.63	31
2012	8	1	22	3.10	28
2013	5	1	21	3.15	30
2014	7	0	22	3.09	30
5-Year Ave.	7	1	21	3.09	29

Chemistry Enrollment by Residency, Age, FSU GPA, and ACT

Year	Residents	Non-Residents	Av. Age	Av. GPA	Av ACT
2010	35	1	21	3.02	23
2011	31	1	21	3.20	25
2012	31	2	21	3.07	25
2013	24	2	22	3.08	25
2014	25	1	22	2.97	25
5-Year Ave.	29	1	21	3.07	24

Enrollment – Gender and Ethnicity

Chemistry BA enrollment by Gender, Ethnicity, Full/Part Time

Year	Total	Male	Female	White	Other Ethnicity	Full Time	Part Time
2010	37	25	12 (32%)	29	8 (22%)	32	5
2011	32	23	9 (28%)	28	4 (12%)	29	3
2012	33	27	6 (18%)	28	5 (15%)	30	3
2013	26	21	5 (19%)	22	4 (15%)	22	4
2014	26	23	3 (11%)	23	3 (11%)	23	3
Average	31	24	7	26	5 (16%)	27	4

Biochemistry BA enrollment by Gender, Ethnicity, Full/Part Time

Year	Total	Male	Female	White	Other Ethnicity	Full Time	Part Time
2010	7	5	2	5	2	7	0
2011	14	10	4	11	3	14	0
2012	9	6	3	8	1	7	2
2013	6	4	2	5	1	6	0
2014	7	5	2	6	1	4	3
Average	9	6	3	7	2	8	1

There seems to be a gradual decline in the percent of female students enrolled in the Chemistry BA program over the past 5 years (from 32% in 2010 to 11% in 2014) but no apparent changes in ethnicity (average of 16% non-white) or full/part time (average of 87% full time) over the past 5 years. We will monitor the percentage of female students over the next 5 years to see if the apparent decline in numbers is a long term trend.

Retention

The numbers reported in the "Retention and Graduation Rates of Full-Time FTIAC Students – By Major" hold little meaning for purposes of this report as a majority of graduates in Chemistry do not enroll in the program as freshman and the average yearly number of students enrolling in the Biochemistry BA as freshman is two. The average "first year retention" over the 9 years reported for Chemistry between 2004 and 2012 is 84% while over the 7 years reported for Biochemistry between 2004 and 2011 the average is 71%. First year retention trends among the few FTIAC students enrolling in these degrees seem to be relatively high. It is likely that the number of FTIAC students enrolling in Chemistry would significantly increase if Ferris had an American Chemical Society approved program.

Program Graduates

Chemistry BA Graduates for 5 years ending May 2013

Academic Year	Graduate Headcount
2008-2009	12
2009-2010	6
2010-2011	10
2011-2012	6
2012-2013	6
5-Year Average	8

Biochemistry BA Graduates for 5 years ending May 2013

Academic Year	Graduate Headcount
2008-2009	5
2009-2010	3
2010-2011	0
2011-2012	2
2012-2013	5
5-Year Average	3

The number of graduates varies somewhat from year to year with an average of 11 graduates per year from the two programs. There are no upward or downward trends. Because of the young age of the program and the relatively low number of annual graduates, there are no obvious program graduate trends to address at this point.

Six Year Graduation Rate

The % persisters reported for Chemistry for the 5 years between 2004 and 2008 are as follows:

2004 (75% of 4)
2005 (33% of 6)
2006 (100% of 1)
2007 (0% of 1)
2008 (0% of 2)

The % persisters reported for Biochemistry for 4 years between 2004 and 2008 are as follows:

2004 (100% of 1)
2005 (100% of 1)
2007 (25% of 4)
2008 (100% of 1)

There is not enough FTIAC data to draw any meaningful conclusions from the “six year graduation rates.”

Graduate Average GPA

Chemistry BA Average GPA of Graduates

Academic Year	GPA
2008-2009	3.25
2009-2010	3.30
2010-2011	3.11
2011-2012	3.41
2012-2013	3.01
Average	3.22

Biochemistry BA Average GPA of Graduates

Academic Year	GPA
2008-2009	3.01
2009-2010	3.28
2010-2011	NA
2011-2012	3.38
2012-2013	3.52
Average	3.30

Graduate average GPAs in both programs vary between 3.0 and 3.5 with no upward or downward trends over the period. We are generally pleased with the average GPAs of our graduates.

Graduate Average ACT

Chemistry BA Graduates Average ACT

Academic Year	Graduates Average ACT
2008-2009	24
2009-2010	24
2010-2011	23
2011-2012	23
2012-2013	25

Biochemistry Graduates Average ACT

Academic Year	Graduates Average ACT
2008-2009	25
2009-2010	25
2011-2012	27
2012-2013	25

The graduate ACT scores in both programs remain relatively constant The graduate ACTs are the same as the ACTs of entering students for Chemistry and slightly lower than the entering ACTs for Biochemistry. There are no issues to address here especially in light of the fact that there are too few Biochemistry graduates for the numbers to have any statistical significance.

State and National Examinations
No certification examinations are used in these programs.

7. Program Value beyond Productivity and Enrollment Numbers

Prior to the development of the Chemistry and Biochemistry BA degrees the only bachelor's degrees available in the sciences were in Biology. A student with a desire to major in Chemistry or Biochemistry did not come to Ferris and if a student developed and interest once here their only option was to transfer. These programs are Ferris' toehold on the retention of students interested in Physical Sciences. They also serve as valuable options to students interested in professional schools and are flexible enough to prepare students for graduate school as well. It is important to note that this is possible even though only one course in the Chemistry program does not serve other programs (though most of the faculty would like to see that change). Beyond this service to the University publications and presentations by faculty and students give Ferris an external presence in the scientific community.

Students benefit from the expertise of the faculty, the opportunity to develop laboratory problem solving skills in classes and through research. Advisors are deeply involved in helping students define their career goals and help tailor an academic path to those goals and success post-graduation.

Outside of the university the Student ACS and program faculty contribute regularly to science events such as science fairs, K-12 classroom experiences, Chemistry Day demonstrations and so on. In direct example, a new degree program in Industrial Chemistry with a concentration in Fermentation Science has been added to the Physical Sciences department. It grew out of the interests of one program faculty member and his work with students in cooperation with a local microbrewery resulting in benefits to both the University and the community.

8. Program Flexibility and Access

Unlike most institutions the Physical Sciences Department offers the opportunity to complete an entire year of General or Organic Chemistry in the summer sessions. This allows students to change majors or make up deficiencies without unreasonable extension of their time on campus. This is especially useful for students that transfer from other schools or from other Ferris programs. Transfer students comprise approximately 70% of Chemistry and Biochemistry majors so it is our interest to facilitate such transfers. The General and Organic Chemistry courses are monitored via American Chemical Society standardized exams which assures us that they compare favorably with offerings at other institutions. The fact that these courses conform to accepted national standards in most cases allows for easy transfer to Ferris of the first two years of chemistry coursework.

Currently no chemistry courses are offered wholly on-line and there are no plans to develop such courses at this time.

9. Visibility and Distinctiveness

Unlike our two-year Industrial Chemistry Technology (ICT) program, which has been in existence for more than 55 years, the chemistry and biochemistry programs are relatively new in our department. They were created a little more than a decade ago, when FSU began to offer B.A. degrees.

For most chemists, a B.S. degree signifies a program of study that includes coursework in general chemistry, organic chemistry, physical chemistry, analytical (quantitative and instrumental) chemistry, physical chemistry, and biochemistry. In fact, the American Chemical Society (ACS), which accredits four-year programs, requires these courses for accreditation. In addition, students must meet certain lab expectations, including labs associated with upper-level courses and independent research opportunities for undergraduates. Faculty must have a teaching load that leaves time for conducting undergraduate research.

Prior to the development of the BA programs, FSU already had many, but not all, of the courses needed for a BS degree. Due to the ICT degree, we already had strong experiences in analytical chemistry (both quantitative and biochemistry). Due to the biotechnology degree, we already had sufficient upper-level coursework (both lecture and lab) for a biochemistry degree and more than enough for a traditional chemistry degree. Due to the chemistry teaching major (housed in the School of Education), we had a one-semester overview course in physical chemistry. However, for the traditional BS degree, we needed a course in inorganic chemistry, a second course in physical chemistry, and lab courses for each.

Due to the variety of programs our lower-level courses serve (including pre-pharmacy and pre-optometry) it is not surprising that students who discovered at the college level that they really enjoyed learning chemistry and working in labs would make the switch to a chemistry degree. In fact, this has been the main source of students for the ICT program for the last two decades (that is, students who enroll in ICT after enrolling in FSU). Students who wanted a four-year degree in chemistry needed to transfer to another institution. Other students tried to make other four-year degrees fit their career goals. Some majored in Applied Biology; others finished a degree in chemical education. For someone truly interested in chemistry (and with aspirations of graduate school or working in industry), these weren't the best possible fit. The chemistry education route had the best match in terms of chemistry coursework, but students were required to add several courses in pedagogical theory and student teaching to receive this degree. They didn't necessarily need these courses if their goal was a position in research. One of our last students to go this route went on to graduate school, ultimately earning a Ph.D. in chemistry. He obviously had the background with our set of chemistry courses to succeed at this level.

Most four-year state institutions the size of FSU or larger offer a BS degree in chemistry, usually with one BS option that meets the ACS accreditation requirements. Many also offer a BA degree; these degrees usually have fewer courses in chemistry, but additional coursework in other areas (including foreign languages).

When FSU inaugurated the BA option, our chemistry faculty decided to add such degrees in chemistry and biochemistry. We already had all the coursework we needed for a biochemistry degree. On the chemistry side, we added an upper-level course in inorganic chemistry as an elective, because we thought that students going to graduate school should have this experience.

We expected that students would use their degrees for three different purposes: seeking employment immediately upon graduation (especially in the chemical industry and closely related industries), looking for admission to professional schools (including medical schools and pharmacy), and furthering their education in chemistry through graduate studies. These routes all require a slightly different set of upper level experiences. Therefore, we purposefully kept our requirements in chemistry to the minimum set that we thought were essential for any chemistry graduate. We also kept open the selection of minors in our degrees. We had considered, for example, requiring students to take one of biology's two minors in the biochemistry program, but to maintain flexibility for students, we decided to leave this option open.

Visibility, distinctiveness and competitive programs

Programs at state institutions in our area that could be considered to be geographically competitive with FSU's programs are those at Grand Valley State University, Central Michigan University, and Western Michigan University. The following table shows a comparison of some features of these programs.

Chemistry Programs at Ferris and Three Nearby Public Institutions

	FSU	**Grand Valley**	**Central Michigan**	**Western Mich.**
2 -year program	Industrial Chemistry Technology	none	none	none
BA/BS concentrations	biochemistry; chemistry	chemistry; biochemistry and molecular bio; environmental; professional; technical	chemistry; biochemistry	chemistry; biochemistry environmental

	FSU	Grand Valley	Central Michigan	Western Mich.
Masters	no degree or coursework	no degree; some coursework for M.Ed.	yes	yes
Ph.D.	no	no	materials/polymer science	chemistry; environmental
ACS accredited BS degree	no	yes	yes	yes
General chemistry class size	75 - 100 (up to 125)	100 - 140	150 - 250	200 - 230
Undergraduate research	yes (limited)	yes	yes	yes

It is interesting to note that all the local state supported institutions have four-year degrees in both chemistry and biochemistry. In fact, our three main competitors have ACS-accredited degrees; our degrees are (currently) both B.A. degrees. CMU and WMU have M.S. and Ph.D. programs in chemistry; FSU does not offer any graduate-level work. Greater opportunities exist for students to conduct research at GVSU, CMU and WMU. In the case of the latter two schools, the Ph.D. programs requires a robust research program in chemistry across the board, so there are simply more opportunities for students to work in a research lab as undergraduates. Some research experience is highly desirable for students going into industry or to graduate programs.

However, there are at least three advantages that students have by completing their majors at FSU. One advantage is Ferris's reputation as a teaching institution. Our introductory courses tend to be somewhat smaller. Some of our organic chemistry labs in the second semester are set up as mini-research experiences. Thus, rather than having a select few students conducting research under the guidance of a professor, students in organic chemistry conduct two research projects as part of their normal coursework. Other laboratory courses that we offer (quantitative, instrumental, biochemistry) are student-driven and provide hands-on opportunities.

Another advantage is the flexibility of a BA degree to allow students to pursue their own interests within a chemistry degree. Students who intend to go for graduate work, for example, are encouraged to take *all* the upper-level chemistry courses offered by the department, so that they have preparation across the board in all five main areas of chemistry. Students who intend to go to medical school don't need all of those courses, but they might add a biology minor to ensure completion of the professional school requirements. Our programs even allow a major to

pursue an interest in technical writing; students in our BA degrees can (and have) combined the science major with a minor in technical writing.

Finally, the existence of a long-standing two-year degree in ICT gives students a competitive advantage that exists nowhere else in the state. At our last program review for ICT, we noted that 75% of the two-year graduates were combining that program with a four-year degree in chemistry. This, in fact, was an excellent route for students interested in an industry job upon graduation. The ICT degree is gives students a strong hands-on background directly related to the chemical industry, while the four year degree provides a good theoretical understanding of the subject. We have learned that both are necessary in today's hiring environment. Some of our employers from the past will no longer look at two-year graduates for entry-level positions. However, they are excited about the two-program combination, because the ICT adds a level of relevance not found in most four-year programs.

Preeminent programs

When we think of preeminent chemistry programs in the state, we'd look to institutions such as Michigan State, Wayne State, and the University of Michigan, all of which offer opportunities at the undergraduate level as well as rich and varied research programs that are cutting edge. Such programs don't serve as a good model for Ferris.

Instead, our developments for the future will focus on enhancing the types of programs we already have. One plan for the future is the development of a B.S. degree in biochemistry, with a greater emphasis on required courses in biology (currently students in the BA degree take three core classes) and additional experience in chemistry (such as quantitative analysis, which they aren't currently required to take).

One recent development has formally combined the ICT and chemistry programs: the BS degree in Industrial Chemistry. The proposal for this program completed the curricular process last year. This program has two concentrations. One is an industrial track, providing students with greater coursework in both applied (industrial) courses as well as a solid theoretical foundation. The other track is fermentation, in which students will have upper-level courses focusing on the chemistry behind beverages (beer and wine), foods (such as milk and cheese) and chemical industries utilizing fermentation processes. One of these industries, for example, is the manufacture of pharmaceuticals; many precursors of modern-day drugs are made from fermentation processes. We expect that this new direction will help cement our department's place in a niche that is unique in this state.

10. Demand

Labor Market Demand Analysis

The most reliable and complete source of information on the chemistry job market in the United States is a census which has been conducted by American Chemical Society (ACS) of its members every 5 years since 1985. The ACS ChemCensus is now conducted yearly. The latest such census, ChemCensus 2014, shows a median base salary increased in the last five years. When looked at the distribution of this mean; however you see that the mean salaries have started to drop across the board for Bachelors, Masters, and Ph.D. chemists. Also according to the ACS 2014 ChemCensus removing the effects of inflation show that chemists salaries are much lower than they were a few decades ago, seeing a delta from 2013-2014 in -3.6% for bachelor's chemists. The percent of chemists employed full time currently sits around 91.9% within the ACS. The chemist population that is unemployed and seeking employment is currently 2.9%.

In 2014 via the ChemCensus here is the breakdown for the jobs held by chemists

- Agricultural/food chemistry 2.6% of total
- Analytical chemistry 14.5% of total
- Biochemistry 5.6% of total
- Biotechnology 3.4% of total
- Chemical education 8.2% of total
- Chemical engineering 4.8% of total
- Environmental chemistry 4.9% of total
- General chemistry 3.0% of total
- Inorganic chemistry 3.9% of total
- Materials science 5.9% of total
- Medicinal/pharmaceutical chemistry 8.1% of total
- Nanochemistry 0.9% of total
- Organic chemistry 11.0% of total
- Physical chemistry 5.9% of total
- Polymer chemistry 5.4% of total
- Other chemical sciences 2.6% of total
- Business administration 1.5% of total
- Computer science 0.6% of total
- Law 1.0% of total
- Other nonchemistry 5.7% of total

***Why do students enrolled in the program choose FSU*?**

Students are attracted to FSU's small class size. This gives the ability to develop interpersonal relationships with faculty that is not the norm in many large universities. A

large amount of the students enroll in the Chemistry and Biochemistry programs after opting out of the Pre-Pharm and or Pharmacy program.

Would students enrolled in the program choose the program at FSU if they had to do it over again?

Students enrolled in the Chemistry and Biochemistry perceived enrichment is dependent on where they go after graduation. Students who go into industry generally would re-enroll in FSU's chemistry program. Some students that go into Academia tend to consider another program at a competitive university.

Would students enrolled in the program recommend the program at FSU to others?

Five of six responding current students said they would recommend the Chemistry or Biochemistry program to prospective students and one student would possibly recommend the programs in the future as the program grows.

Projected market outlook for demand for program graduates.

The chemical market for program graduates has been lackluster from 2010-2013, but looking at market projections the chemical marketplace is expected to rebound moving forward into 2016.

Would alumni choose the program at FSU if they had to do it over again?

Most alumni would choose a program at FSU if they had to do it over again.

Would alumni recommend the program at FSU to others?

Four of the nine responding alumni reported that they were very satisfied with the program and five were somewhat satisfied.

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11. Student Achievement

When a student chooses a Chemistry or Biochemistry major there is a well-defined measure of achievement in the classroom but it is not always obvious the student understands that there is a significant contribution to success from participation in "extracurricular" experiences. In Chemistry and Biochemistry these experiences are available primarily through the Student Affiliate chapter of the American Chemical Society, the Ferris Honors Program, through participation in research and employment within their discipline on campus.

Employment

Of the 48 students who have graduated with either a Chemistry BA degree or a Biochemistry BA degree from Ferris 30 have worked on campus as a student. The students that worked on campus averaged 945 hours which is approximately 8 hours/week if spread out over 8 semesters). A large part of this employment has been in the Physical Sciences stockroom or as aids to classroom and laboratory functions. Several have served as SLA instructors.

Honors Program

Over the past five years we have seen an increase in the number of honors students in our programs which is suggestive of an improvement of our image.

Academic Year	# of Students in Honors
2010-2011	2
2011-2012	5
2012-2013	5
2013-2014	6
2014-2015	7

The community and volunteer service required in the honors program are complimentary to the experiences available to all participating students in the ACS. The total number of volunteer hours reported for current students and graduates of the past 5 years is 1177. Of 48 graduates 15 (31%) reported a total of 915 volunteer hours, which is an average of 61 hours/student for the 15 who reported. Of the 21 current students 7 (33%) reported a total of 262 volunteer hours which is an average of 37 hours/student for the 7 who reported.

RSO

The American Chemical Society Student Affiliates Chapter FSU RSO has received a number of awards from the American Chemical Society over the past 5 years.

> ***The Green Chemistry ACS Award Chapter for three academic years 2010, 2011, and 2012.***
> ***Outstanding ACS Student Chapter for the 2010 academic year.***
> ***Commendable ACS Student Chapter for two academic years 2011 and 2012.***
> ***Honorable Mention ACS Student Chapter for the 2013 academic year.***

Participation in ACS or other RSOs is showing a slight downward trend that may reflect cyclical trends in program enrollment.

Academic Year	# of Students in an RSO
2010-2011	25
2011-2012	30
2012-2013	28
2013-2014	25
2014-2015	18

Research

While opportunities for research in Chemistry and Biochemistry are not extensive, they are available and productive. Over the past five years (four since the initiation of Summer Research Fellowships and Student Research Assistant programs) nine Chemistry majors have been supported by fellowships and one by an SRA. One Biochemistry major has received an SRA and seven have done research through Independent Study courses (CHEM 497). The total amount of research hours for the two programs comes to 4460. The results of these projects have been presented on campus and at regional and national conferences.

Departmental Recognition

The department has encouraged scholarship and achievement with a number of scholarships. In the past five years we have awarded 19 students various cash scholarships from the following programs:

Charles and Mary Bacon Annual Scholarship
Dr. Henry Reitz Endowment Scholarship
Physical Sciences Department Faculty and Staff Annual Scholarship

In addition, we have recognized an Outstanding Chemistry and Outstanding Biochemistry student from among the graduating seniors. These scholarships and awards are partly based on academic achievement but also take into account these other indicators of student achievement.

It is difficult to assess the effect these alternate experiences have on ultimate student success. Based on conversations with graduates these experiences have been invaluable and have helped prepare them for the workplace, professional schools and graduate programs. Design of a method to evaluate these effects more quantitatively is indicated.

12. Employability of Graduates

Employment Post-Graduation

All 9 Chemistry and Biochemistry graduates (100%) responding to our survey report being employed full time. We have no salary information for these 9 graduates. We have been able to make contact with 20 (59%) of our 34 Chemistry graduates of the past 5 years. Of these 20 graduates 15 (75%) are employed as chemists, 2 (10%) are enrolled in Chemistry PhD programs, 2 (10%) are in optometry school, and 1 (5%) is in nursing school. Of the 15 employed chemistry graduates, 4 are employed in the pharmaceutical industry, 3 in the rubber industry, 1 in the food industry, 1 in the paint industry, and 1 by an environmental firm. In short 100% of the Chemistry BA graduates we have been able to contact are either employed as chemists or pursuing further education. Although this appears to be an excellent record, the status of the other 41% of Chemistry graduates is currently unknown. Of the 13 Biochemistry graduates two could not be contacted, one is a practicing dentist, 2 are employed in the pharmaceutical industry,1 in the rubber industry, 2 in sales, 1 with a producer of environmentally friendly cleaners, 2 in with analytical firms, and 2 are in education. Our future goal is to improve our connection with graduates and to build stronger connections with their employers for the purposes of maintaining a more complete data set and for obtaining employer feedback.

Stakeholder Perceptions of the Employability of Graduates

The nine responding alumni, when asked to compare their background and skills to other Bachelor entry-level personnel or graduate students in 11 different areas, gave the responses listed in the Table below.

In comparison to others at same level my…is comparable.	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Chemistry background	3	6		
Laboratory experience	5	4		
Problem solving skills	5	3	1	
Critical thinking skills	3	6		
Computer background	2	6	1	
Math background	5	3		1
Writing background	3	5	1	
Oral communication skills	3	4	2	
Interpersonal comm. skills	1	6	1	
Social awareness background	2	5	2	
Cultural enrichment background	3	5	1	

There was an overall agreement among alumni that their chemistry background, laboratory experience, and critical thinking skills were comparable to others at their level. Overall 89 (99%) of the 99 responses collected indicated that alumni believed that had comparable backgrounds or

skills to other Bachelor entry level personnel or graduate students. We do not current have and advisory board and employers have not responded to requests for feedback on our graduates. Three of five faculty responding to the survey strongly agree that the programs are recognized by industry as a resource and two faculty somewhat agree.

Career assistance for graduating seniors is provided by the chemistry and biochemistry advisors who give students advice on resume construction and facilitate connections with potential employers in addition to discussions on possible career directions held throughout their undergraduate careers. Students are also referred to career services for resume advice and interviewing skills. Occasional opportunities arise for students to talk with potential employers or Ferris graduates who visit campus.

13. Faculty Composition and Engagement

For the purposes of the following sections, "program faculty" are defined as those department members who have taught the lecture portion of required CHEM courses in the chemistry and biochemistry BA programs over the past year. This does not include the entire Physical Sciences Department, because some of the chemistry faculty in the department teach service courses for other areas, while other faculty teach outside of the discipline of chemistry.

Organization.

Number and role of faculty within the Chemistry and Biochemistry BA programs	
Number of tenure-line or tenured faculty teaching within the program:	9
Number of tenure-line or tenured faculty teaching the majority of their load on the Big Rapids campus:	9
Number of tenure-line or tenured faculty teaching the majority of their load in off-campus locations:	0
Number of tenure-line or tenured faculty teaching the majority of their load fully online:	0
Number of full-time temporary faculty teaching within the program:	1
Number of full-time temporary faculty teaching the majority of their load on the Big Rapids campus:	1
Number of full-time temporary faculty teaching the majority of their load in off-campus locations:	0
Number of full-time temporary faculty teaching the majority of their load fully online:	0
Number of adjunct faculty teaching within the program:	0
Number of adjunct faculty teaching the majority of their load on the Big Rapids campus:	0
Number of adjunct faculty teaching the majority of their load in off-campus locations:	0
Number of adjunct faculty teaching the majority of their load fully online:	0

For the most part, this mix of faculty serves our program well. As a laboratory-based program, all of our faculty teach on the Big Rapids campus and none of our chemistry courses are offered

online. Furthermore, 90% of the faculty who teach chemistry lecture courses in the program are tenured or tenure-track; the remaining non-tenure-track faculty member has been with the department for a number of years. This provides a level of stability for students in the program. Faculty within the general chemistry group, for example, meet regularly to discuss textbook adoptions, course outcomes, laboratories and other issues. This helps to assure consistency in the shared general chemistry course.

Our department currently has teaching faculty with Ph.D.'s in the areas of analytical chemistry, inorganic chemistry, organic (and polymer) chemistry and biochemistry. The one area we currently lack this level of expertise is in physical chemistry, because our physical chemist is on a long-term release time assignment. We plan to address this missing expertise with a new faculty hire this year.

Curriculum Vitae.

Highest Degree and Teaching Loads for Tenure-Line/Tenured Faculty in Program								
Faculty	**Degree**	**Teaching Loads**						
		F12	**S13**	**F13**	**S14**	**F14**	**S15**	**Avg**
Adsmond, Dan	Ph. D.	1.185	1.185	1.0	1.0	S	1.0	1.074
Balanda, Pete	Ph. D.	1.417	1.0	1.0	1.0	1.125	1.0	1.090
Colvert, Kim	Ph. D.	1.167	1.0	1.167	1.0	1.083	1.0	1.070
Di Raddo, Pasquale	Ph. D.	1.417	1.417	1.333	1.083	1.333	1.0	1.264
Killian, Bill	Ph. D.	1.167	1.250	1.167	1.167	1.167	1.0	1.153
Kollalpitiya, Yamuna (Konara)	Ph. D.	NH	NH	1.0	1.0	1.083	SL	1.028
Partigianoni, Colleen	Ph. D.	1.0	1.0	1.0	1.0	1.0	1.0	1.000
Shetty, Prabhakara	Ph. D.	1.0	1.0	1.0	1.0	1.0	1.0	1.000
Thomson, Mark	Ph. D.	1.0	1.083	1.0	1.0	1.0	1.185	1.045

NH = Not Hired (yet); faculty member did not teach because she had not yet been hired.

SL = Sick Leave; faculty member was on sick leave for the majority of the semester.

S = Sabbatical: faculty member was on sabbatical leave for the semester.

Highest Degree and Teaching Loads for Full-Time Temporary Faculty in Program								
Faculty	**Degree**	**Teaching Loads**						
		F12	**S13**	**F13**	**S14**	**F14**	**S15**	Avg
Burns, Francis	Ph. D.	1.333	1.083	1.0	1.083	1.0	1.185	1.114

Vitae for all of the faculty listed above (tenure-line, tenured, full-time temporary) are included in Appendix VI of this document.

Note: Omitted from the previous tables is David Frank (department head, Physical Sciences). He taught general chemistry lecture and lab during the period covered by these tables, so his resume has been included in the appendix. Piram Prakasam has been omitted because he is currently is serving in the International Office on a 100% basis. As mentioned earlier, other faculty in the department teach chemistry courses (namely, Beth Miller, James Weaver, and Mary Bacon—all as adjunct instructors); however, they have not been included because they typically don't teach the lecture sections of courses in the chemistry or biochemistry BA programs. There are also departmental faculty who teach in other areas (forensic chemistry, astronomy, physics, geology) who have not been included.

Service

Information in this section has been primarily obtained from faculty vitae.

Achievements in program, department, college, and university service for all tenure-line and tenured faculty over the last three years.

- At the department level, faculty serve on standing departmental committees, including Curriculum; Planning; Faculty Development and Travel; Safety; Assessment; and Tenure Review.
- Other ad hoc departmental committees over the last five years have included search committees, most recently a search committee that resulted in the hire of our new biochemist (Yamuna Kollalpitiya). In addition, a group of faculty developed the proposal for the new BS degree in Industrial Chemistry.
- At the college level and intra-departmental level, faculty have served on standing committees such as Academic Standards and Policies; Assessment; Curriculum; Diversity; Graduate

Education; Planning; Promotion and Merit; Sabbatical Leave; Special Grants; Biotechnology Advisory Committee.

- At the college level, faculty from the chemistry group have chaired such committees as Special Grants and Promotion and Merit.
- At the college level, faculty have served on ad hoc committees such as the Dean's Search Committee.
- At the college level, faculty have participated in events such as Homecoming outreach (CAS tent); CAS student-faculty mixer; CAS student recognition event.
- At the university level, faculty have served on: Academic Senate; outside academic program review committees (nursing); Senate Health Promotions and Substance Abuse Committee; Senate Student Life Committee (including a term as chair); Senate Academic Standard and Policies Committee; (ad hoc) Student Enrollment Committee; Search Committee for Dean of University Library; Academic Program Review Council.
- At the university level, faculty have participated in Dawg Days.
- Faculty have served as advisors to student organizations, including the Biotechnology Student organization; Pre-Optometry club; and Student Affiliate of the American Chemical Society (SAACS); pre-medicine club; Kappa Psi Pharmaceutical Fraternity.
- The chemistry faculty have been involved in an exploring an ongoing relationship with a national research university in Kazan, Russia. One faculty member (Dan Adsmond) and the department head (David Frank) made a trip to Kazan in October 2014; the entire department, but especially the chemistry faculty, hosted two representatives of the university in a return visit in April 2015.
- Faculty have advised students in the (now-defunct) Math, Science & Technology program for high school students; faculty have also judged in local sciences fairs for middle school and high school students.
- One of our faculty members, in conjunction with a student, has served as a consultant with Crankers Brewery. This consultation has also involved on-site research in analytical chemistry.

Achievements in program, department, college, and university service for all full-time temporary faculty over the last three years.

- One faculty member has served as our departmental webpage coordinator, as well as on the departmental assessment committee.

Research.

Achievements in research for all tenure-line and tenured faculty over the last three years.

- Two faculty have had research sabbatical leaves. One was a one-semester leave in organic chemistry; the other was a year-long leave in biochemistry. Upon return from sabbatical, both professors have engaged undergraduate chemistry and biochemistry (and biotechnology) majors in research projects.
- Our organic chemistry faculty have sponsored annually a Chemistry On The Bridge poster session, at which students in the second semester organic chemistry lab present the results of their long-term mini-research projects.
- Dan Adsmond has had three publications since 2011, and he has made five conference presentations since 2012 (most involving undergraduate students). He made four invited plenary presentations in Kazan, Russia, and has a further manuscript submitted for publication. He also has sponsored five students over the last three years with research fellowships, and has received released time with a faculty research fellowship for his own research.
- Peter Balanda has had three presentations/publications since 2014. He has supervised two research projects of students in the summer student research fellowship program.
- Kim Colvert has nine presentations since 2012 involving students performing research in biochemistry.
- Pasquale Di Raddo has made five off-campus presentations since 2011. He sponsored two students with posters in the annual CAS student recognition event.
- David Frank has one publication (in association with Francis Burns) in 2013. He has been a co-author of five presentations since 2013.
- Bill Killian has a poster presentation on the ICT program at a national ACS meeting. He has a published book chapter on Workplace Behavior with Mark Thomson.
- Yamuna Kollalpitiya has one presentation at a Midwest Regional meeting of the American Chemical Society in 2010.

- Mark Thomson has sponsored and supervised the undergraduate research of eight students since 2011. These projects have resulted in eight student/faculty presentations at various venues. He has made five other presentations since 2012. He also has a published book chapter in cooperation with Bill Killian.

Achievements in research for all full-time temporary faculty over the last three years.

- Francis Burns has five presentations since 2011. He also has one publication in 2013.

Continuing Education.

Achievements in training, development and other continuing education by all tenure-line and tenured faculty over the last three years.

- Peter Balanda attended the 44th National Organic Chemistry Symposium; Integrating Contemplative Practices into the Teaching and Learning Experience; and the 2014 Biennial Conference on Chemical Education.
- Kim Colvert conducts annual (unpaid) research in biochemistry during the summers at labs at the University of Kansas in Lawrence.
- Pasquale Di Raddo attended the latest Biennial Conference on Chemical Education, including a soap-making workshop at the conference.
- David Frank attended the latest Biennial Conference on Chemical Education.
- Yamuna Kollalpitiya is currently conducting work as an FSU Junior Faculty Fellow (sponsored by the faculty center).
- Colleen Partigianoni is the only member of our department to have attended both of the last meetings of the Biennial Conference on Chemical Education.
- Mark Thomson has attended four ACS Leadership Development workshops at national and regional meetings.
- Many faculty have attended workshops and other professional development initiatives sponsored by the Faculty Center for Teaching & Learning.

Achievements in training, development and other continuing education by full-time temporary faculty over the last three years.

- Francis Burns has attended or organized four workshops since 2011.

Stakeholder Perceptions of the Quality and Composition of Faculty.

Our faculty administer either the SAI forms or IDEA forms at the end of the semester. All non-tenured faculty are required, by college policy, to use the IDEA form. Results from these student evaluations are given directly to individual faculty members and the department head. All faculty members (especially those who have used the more complex IDEA evaluations) are invited to discuss their results with the department head, and tenure-track faculty are required to do so. Tenure-track faculty members learn how to interpret the student feedback and turn it into potential action steps for the classroom. They are encouraged to look at what they have done well, in addition to where they believe improvements can be made.

Our department uses these student evaluations tools for personal improvement, and not for departmental discussion. Student evaluations for tenure-track faculty are shared with their candidate review committees, and these ratings for part of the basis for their feedback to tenure candidates. The committees also consider other evidence of teaching quality, including written classroom materials and impressions gained from class visitations.

In our student survey (Appendix V), we asked their opinions about courses in the program. For all the courses, we asked if the course:

- Helped me learn basic facts and info about chemistry
- Prepared me well for subsequent courses in chemistry
- Improved my ability to think critically about chemistry

For courses that had a laboratory component, we also asked if the:

- Lab experience enhanced my understanding of chemistry
- Lab experience improved my lab skills

Students responded to each item on a scale of one to four (1 = strongly disagree; 2 = somewhat disagree; 3 = somewhat agree; 4 = strongly agree). With the exception of the laboratory questions for one course, all of the averages were between 3.00 and 4.00. This is a strong endorsement from the students of the quality of their education. The one exception was CHEM 451 (physical chemistry); here the laboratory questions were rated 1. This isn't surprising, as this

course doesn't have a lab and we didn't intend to include these two questions. Fortunately, the responses are an honest reflection of a non-existing course component.

An interesting result from these questions is the split between the first three questions and the last two questions depending on the level of the course. On the analytical side of chemistry, one can think of courses increasing in level from general chemistry (CHEM 121/122) to quantitative analysis (CHEM 231) to instrumental analysis (CHEM 317). At the lowest level, students rated the first three questions higher than the lab questions. At the intermediate level, all five questions were rated the same. At the upper level, the lab scores were higher. This may be due to a couple of factors. One is the increasing sophistication of the labs. At the lower level, most labs can be completed on one three-hour period. At the upper-level, students have longer projects that may extend across more than one period. The second is that the upper-level labs have increasing relevance for the students' careers. Labs at the junior and senior level may require students to devise their own procedures, sometimes after studying the literature. This is the kind of experience that graduates need when they leave campus for work.

One other indicator of the quality of our faculty is recognition by their university peers for the FSU-wide distinguished teacher award. Two current members of our chemistry group have won the award, and three others have been nominated and made it to the latter stages of the process. Since we have nine tenured/tenure-track faculty directly involved with the program, this is one indication that students are highly satisfied with the instruction they receive in the chemistry and biochemistry BA programs.

Program Procedures and Policies

Most of the direct work of the programs is left in the hands of the coordinators, Kim Colvert (for biochemistry) and Dan Adsmond (for chemistry). They advise all the students in their respective programs, and they make recommendations for changes as appropriate. For example, Dr. Adsmond recommended the inclusion of Inorganic Chemistry into the program when the course was created, and Dr. Colvert is studying the possibility of a BS degree in biochemistry. These two professors also oversee the assessment of biochemistry and chemistry at the program level.

Hiring and Retention

The Department of Physical Sciences follows college and university policies and procedures with respect to hiring. When a search committee is formed to hire a tenure-track biochemist or chemist, the committee is composed of a majority of faculty from the chemistry group. We do encourage at least one faculty member from outside this group to serve on the committees to

provide additional perspective. The search committee is charged with determining the required and preferred qualifications for the candidates, as well as screening the applicant pool and making telephone interviews to the top candidates. At this point the entire department is expected to step in and assist with the on-campus interview stage of the search.

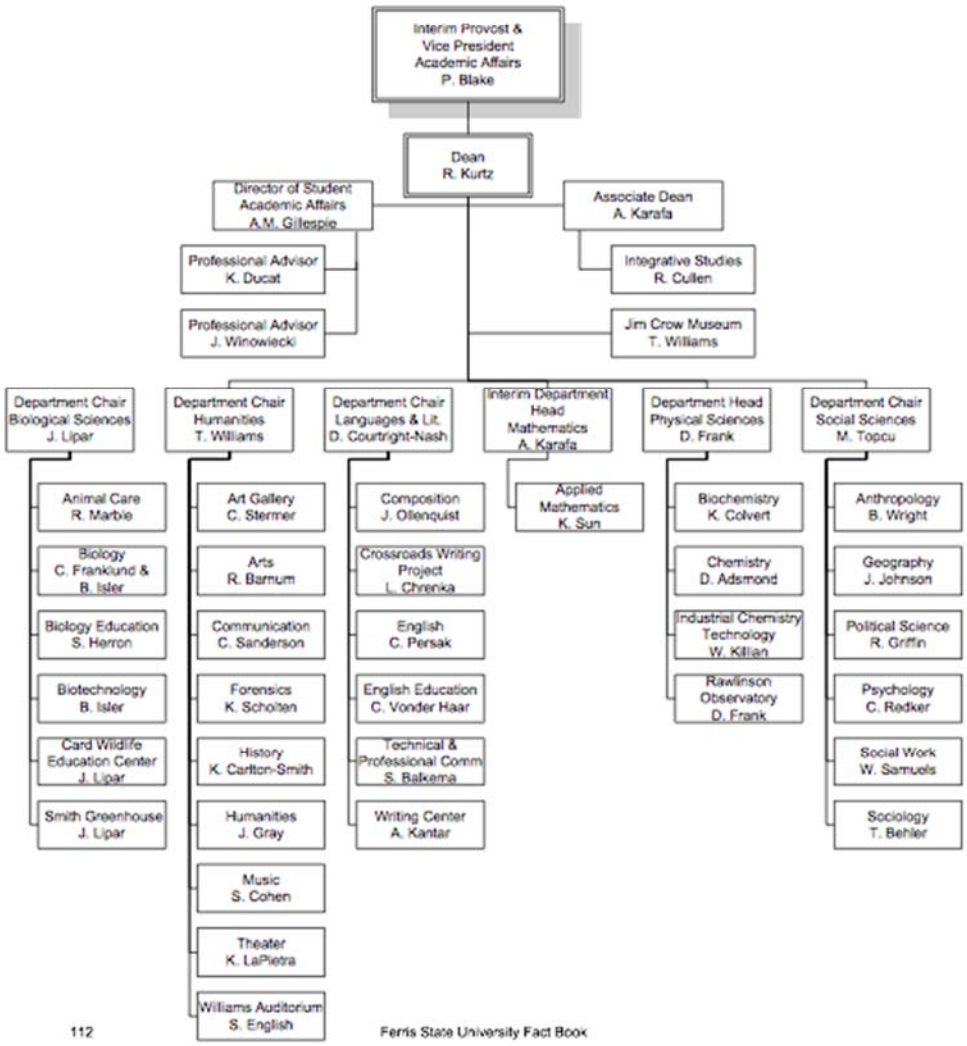
All candidates for tenure-track positions are expected to have a Ph.D. in the relevant subject area by the time of employment. Some of our adjuncts (particularly at Levels 1 and 2) have M.S degrees in the areas they're teaching.

Tenure-track hires are assigned both a mentor and a candidate-review committee (CRC). The mentor is a go-to person who assists with day-to-day orientation to the department. The CRC provides annual feedback so that tenure candidates understand their strengths and weaknesses as they work towards tenure.

ORGANIZATIONAL CHARTS

FERRIS STATE UNIVERSITY
ACADEMIC AFFAIRS DIVISION

COLLEGE OF ARTS & SCIENCES



14. Program Administration and Support

The previous page shows the most recent "official" organizational chart for the College of Arts and Sciences.

Administrative structure

The College of Arts and Sciences has moved to a chair model for its departmental structure. At the time that this conversion was made, two departments had (administrative track) department heads: the Mathematics Department and the Physical Sciences Department. These two departments will continue to have a department head until the current incumbents leave their positions. David Frank currently serves as the head of the Physical Sciences Department. The other five departments in the college (one new department, Social Work, comes into existence this fall) have chairs. In practice, a chair and a head occupy the same level; either is responsible for the programs in his/her department.

Dean Rick Kurtz left his position as dean of the college this summer, taking on the position as president of a university in Ohio. Furthermore, a new program has been created in our department (the BS degree in Industrial Chemistry) with two concentrations. An update to the organizational chart that shows the Physical Sciences portion of the chart would include the following information:

Name	Title	Highest Degree
Andy Karafa	Interim Dean, College of Arts and Sciences *	Ph.D.
Joe Lipar	Interim Associate Dean, College of Arts and Sciences	Ph.D.
Trinidy Williams	Interim Associate Dean, College of Arts and Sciences	M.F.A.
David Frank	Head, Department of Physical Sciences *	Ph.D.
Kim Colvert	Program Coordinator, Biochemistry BA *	Ph.D.
Dan Adsmond	Program Coordinator, Chemistry BA *	Ph.D.
Bill Killian	Program Coordinator, Industrial Chemistry AAS	M.S.
Bill Killian	Program Coordinator, Industrial Chemistry BS, Manufacturing Concentration	M.S.

Mark Thomson	Program Coordinator, Industrial Chemistry BS, Fermentation Concentration	Ph.D.
Tom Brennan	Rawlinson Observatory Director	Ph.D.

Positions that involved direct supervision of students in the biochemistry and chemistry programs are marked with an asterisk.

The interim dean holds regular (twice monthly) meetings with the department heads/chairs of the college, keeping us abreast of issues affecting the college as a whole. He also holds regular monthly meetings with each department administrator.

Due to the small size of our department's programs, the department head usually consults individually with the coordinators of the two BA programs. We have group meetings of all the coordinators for curricular and assessment issues.

We intend to keep this structure for the immediate future.

Support staff

The department has two full-time support staff positions: a department secretary (Leona Royer) and a laboratory technician (currently vacant; search underway). The secretary provides assistance to the program coordinators; the laboratory technician assists with preparation of labs across the department. Both positions are also assisted by several student employees; in fact, the stockroom usually has a student employee available for each hour that a lab meets.

Because our new BS degree will increase the preparation time for the additional labs, our PCAF for the program had a cost estimate that includes an additional half-time laboratory technician, to be brought on-board when needed (approximately the third or fourth year of the new program).

No other change to the support staff structure is anticipated in the immediate future.

15. Support Services

Among the support services that assist the program, including the faculty and students, are the following:

Faculty Center for Teaching and Learning. Several department faculty have made use of the faculty center. Mini-travel grants have supported several people attending professional conferences, especially those faculty making presentations. Faculty have also benefitted from the variety of on-campus workshops offered by the center. Our incoming faculty have attended the center-sponsored activities two weeks before classes, as well as the bi-weekly sessions for new faculty during their first year on campus.

FLITE. We have made use of the facilities in FLITE for student presentations, especially for students who have completed extensive research in their organic chemistry labs. Their conference rooms give a professional setting not unlike the facilities students will encounter at a meeting. The library has an online subscription to the American Chemical Society journals, which provides access to faculty and students to the professional literature they need. Finally, our liaison librarian was himself trained as a chemist, so he is well attuned to the needs of all of our programs.

IT services. Much of our instrumentation has a computer interface, and IT has helped us find appropriate computers for new instruments. As is true for many other academic institutions, we try to keep our expensive instruments on-line as long as possible. Sometimes new computers and operating systems are not compatible with our older instruments, so we especially rely on IT to provide the equipment we need to keep the computers running.

Instrument repair. This department has often helped troubleshoot, diagnose and repair problems on our instruments. Again, as our instruments age, we turn to their services more often.

Tutoring services and the structured learning assistance (SLA) program. The tutoring center offers a full array of services for students taking lower-level required courses in chemistry, physics and mathematics. In addition, the SLA program has provided assistance to a variety of our chemistry classes, notably including all the sections of our Quantitative Analysis (CHEM 231) class. This class is taken after students have completed a year of general chemistry—so the students already have seen (if not necessarily mastered) a large amount of chemistry. However, many students (chemistry majors and non-majors alike) have found this class to be difficult. Student success rate in earning a C or higher in this class increased considerably after all the sections became SLA sections. Not only do our students benefit from tutoring services, but many of our better students become tutors or SLA facilitators themselves.

16. Facilities and Equipment

***Space*:**

Lecture Rooms: SCI : 102, 111, 117, 120, 336, Starr 233 and occasionally IRC 120

Teaching laboratories: SCI: 301, 309, 314, 320, 321, 328, 330, 332, 333, 335, 337, 343

Research Laboratories: SCI 313, 332A, 337, 338, 343, and the new Shimadzu Core Research Facility.

When scheduling classes, the Department of Physical Sciences has first access to all of the lecture rooms above except IRC 120 and SCI 120, which we share with biology. Science 102 seats up to 172 students and can accommodate our large classes such as General Chemistry and organic. chemistry. The only other relatively large lecture room is SCI 120, which seats up to 80 students. This room is very cramped because the fixed seats are so close together, and it is difficult to administer exams in this room.

We have access to the teaching labs listed above. We share SCI 337 & 343 with the biology department. In general, there is not a need for more teaching laboratory space.

SCI 313 and SCI 332A are used solely as chemistry research labs, and not used for teaching. There is a small research lab for biochemistry, SCI 338, but student researchers in biochemistry also use SCI 337 and SCI 343, which are also used for biochemistry and biotechnology courses. This is not problematic because these teaching labs are often unoccupied.

The new Shimadzu Core Research facility, opening this Fall 2015 semester, is intended to be used by Department of Biological Sciences, the Department of Physical Sciences and the College of Pharmacy. Although this is a shared space, and faculty members in our department won't "own" a space, the facility will provide access to some high-end research equipment.

Although our lecture and teaching lab space is adequate for our needs, our space for student research is limited. Our space for student research in biochemistry is adequate, because researchers can use the teaching labs. Such is not the case for chemistry, where teaching labs are often occupied. We have one designated research space for analytical/ instrumental chemistry, and one research space for organic chemistry. In general research space is shared amongst faculty, and there is not enough space for each faculty member to "own" their own space. Since our newer faculty have more interest in conducting research, and we have increasing numbers of students who intend to go to graduate school, we may need to support greater amount of undergraduate research, including more space.

***Computers*:**

All of our faculty members are equipped with a computer in their office. Each of our lecture rooms listed in the space section is equipped with a computer. Most of our computers in the

laboratories are integrated with equipment to enable analysis of results. However, many of our labs also have one or two additional computers for student use. Many chemistry majors utilize the ICT open lab (SCI 309), which has computers and a small resource library. This area is open from 8–5 Monday through Friday. On the first floor, the Reitz Reading Room is another resource area that has scientific literature and computers for students to use. Students in the biochemistry program typically utilize the computers the smaller biochemical laboratory, SCI 338.

The General Chemistry labs are also equipped with Vernier Data–Collection Technology. There is a total of 24 LabQuest computing devices, which can be interfaced with a computer or used standalone to collect data. The LabQuest devices are equipped with graphing software. We have a least 12 probes for measuring temperature, pH, gas pressure, electrical conductivity, and visible absorption and emission spectra. We also have several Vernier drop counters, which can be used in place of burets, for adding solutions dropwise, and monitoring volume of solutions added.

Data collection with the Lab Quest computing devices is more time efficient than collecting data with computers, because the lab is only equipped with three computers. Instead of waiting in line to collect data, the 24 LabQuest devices allow all students to collect data simultaneously. The time saved in data collection can be spent on data analysis, and so, in principle, students can learn more from the experiments. The Vernier software also provides the students with guidance in data analysis.

One disadvantage of the Vernier Data–Collection Technology is that students are not exposed to more standard instrumentation or glassware that they are likely to encounter, such as Spec 20 for monitoring uv-visible spectra, or burets which are used to precisely add volumes. Computer generated graphs also do not give students experience in preparing graphs by hand.

***Equipment*:**

Classroom Instructional Equipment:

The department has access to two large lecture rooms: SCI 102 (which is reserved for our department,) and SCI 120 (which we share with the biology department.) SCI 102 can seat up to 172 students and SCI 120 can seat up to 80 students. Large classes, such as general chemistry and organic chemistry, are usually taught in one of these large lecture halls. The department also has access to smaller classrooms in Science and Starr for smaller classes.

Most of the classrooms, both large and small, are equipped with at least one computer, one projector, one document camera and a whiteboard. SCI 102 was renovated in summer 2010. Chalkboards were replaced with whiteboards, overhead projectors were replaced with document cameras and an additional projector and an additional screen were added.

Laboratory Equipment:

In General Chemistry, much of the equipment needs include an adequate supply of analytical balances, pH meters, centrifuges, and tabletop visible spectrophotometers. The general chemistry labs are also equipped with the Vernier equipment previously discussed in the computer section.

The following table shows the major equipment used in upper level chemistry/biochemistry courses. Our most recently purchased equipment is the mass spectrometer, which assists with the identification and characterization of chemicals. Although we do not own, we also have access to the equipment in the new Shimadzu Core Research Facility. The equipment in this facility is also listed on the table. All of the equipment listed on the table is available for student use.

Room	Area	Instrument
SCI 301	ICT	2 Buchi Rotovaps / waterbath
SCI 309	ICT	Griffith Technologies Mass Spectrometer

Perkin–Elmer atomic absorption spectrometer

FT–NMR (nuclear magnetic resonance) spectrophotometer with Anasazi upgrade

Nicolet 6700 FT–IR (Thermo Scientific)

Carey 1E UV-visible spectrophotometer

Hitachi Auto sampler L – 7200

2 Varian 330 gas chromatographs

Varian 430 gas chromatograph

2 Spectronic 200 visible spectrophotometers

Vernier Mini gas chromatograph

Varian pro star solvent delivery model 210 with UV-vis Detector model 320

SCI 321A	Quant.	4 Mettler Toldeo Analytical balances
		Spectronic 200 Visible spectrophotometer
		6 Spectronic 20 Visible spectrophotometers

		Agilent UV–visible spectrophotometer
		13 Corning pH Meter 440
		4 Accument AB15 Plus pH meters
		Accument pH meter Mode 825 MP.
		Waters 501 HPLC pump (model 430 conductivity detector)
		Beckman 1108 Solvent delivery module
		Millipore waters-differential refractometer R401 (differential electronic unit; Waters model 441 absorbance detector)
		Beckman 127 solvent module system gold-166 detector
SCI 330	Organic	Mattson Genesis Series FTIR
		Perkin Elmer FTIR spectrophotometer (Pantoon 1000)
SCI 328	Organic	4 Buchi Rotovap R–3000
SCI 328A	Organic	Varian 3300 gas chromatograph
		SRI 8610C gas chromatograph
		Agilent 6850 Network GC system
		PARR Pressure reactor
		Sonicator
SCI 332A	Organic	Heidolph rotovap
		Schlenk line
		2 PARR 4842 Pressure reactors
		Perkin Elmer IR Spectrophotometer 297
		Precision Vacuum Oven

SCI 313	Research detector	2 Waters associate model 441 absorbance
		HP 6890 series GC system
		SpectraSYSTEM UV 3000 HPLC detector
		Shimadzu CTO-20A HPLC with refractive index detector
SCI 338	Biochemistry & Biotechnology	Beckman system gold (127 solvent module; 166 detector
		MSE Soniprep 150 sonicator
SCI 343	Biochemistry & Biotechnology	Hoshizaki ice maker F251B
		Beckman L8–80M ultracentifruge
		Gallenkamp orbital incubator
		DuPont Sorvall RC-5B refrigerated superspeed centrifuge
		Eppendorf centrifuge 5141C & model 5415D
		Multifuge X1R centrifuge
SCI 337	Biochemistry & Biotechnology	Perkin–Elmer gene amp PCR system 2400
		Varian Carey 50810 uv-visible spectrophotometer
		Fisher Biotech electrophoresis system FB650
		Boeker Scientific incubator/shaker-model 136400
		Varian Carey single cell peltier accessory
		2 Carey 50 Bio uv-visible spectrophotometer
		2 Fisher Biotech Electrophoresis Power Supply
		Fisher Isotemp Incubator

Shimadzu Core Research Facility spectrometer	LCMS–8040 Triple quadrupole liquid chromatograph mass
	GCMS_QP2010 Ultra
	IRtracer–100 with IR microscope
	BioSpec-nano Micro-volume UV–Visible spectrophotometer
	AXIMA performance MALDI TOF/TOF Mass Spectrometer
	UV–2600 (or UV–2700) uv-visible spectrophotometer
	AUW–D Series Dual-range Semi-Micro Balances
	Prominence preparatory HPLC system

Adequacy of equipment

For the most part, the classrooms in which we teach are well equipped with enough technology so that instructors can use a variety of teaching strategies.
The remodeling of SCI 102 has made the room more versatile. The extensive whiteboards provide adequate writing space and the computer meets the needs of the professors who use powerpoint presentations, 3D images, or online access. Replacing overhead projectors with document cameras saves the expense and hassle of overhead transparencies and overhead markers, and images are usually more legible. Perhaps the biggest improvement is the ability to project two different images simultaneously with the two projectors.

One feature lacking in SCI 102 is that the room is not conducive to students working together in small groups. Although the seats swivel, they are held in fixed positions, making it difficult for more than 3 students to interact face-to face. With the present seating configuration, one or more students in groups of four must stand.

The equipment in the labs is also adequate, but several items in both chemistry and biochemistry labs were purchased more than 20 years ago. There is no guarantee that funds will be immediately available to upgrade or replace the old equipment. Due to cost, we could potentially be without some equipment if it fails. Moreover, it is difficult to find parts needed to repair outdated equipment. The old equipment is often not compatible with newer parts. For example, our old infrared spectrometer is not compatible with newer printers. Unfortunately there is no one dedicated to maintenance of the equipment, so we have some older equipment that needs attention and sits unused. Due to limited supply, students are sometimes backed up waiting to use certain pieces of equipment.

***Impact on instructional delivery*:**
In our development of a BS degree in Industrial Chemistry Technology, we have requested a half-time position for a lab technician devoted to upkeep of the equipment. This position would provide us with an expert to repair some of our older equipment, which currently sits unused.

17. Perceptions of Overall Quality

Chemistry-Dan Adsmond

I give the Chemistry BA program a rating of 85 out of 100. We have faculty members with expertise in all areas of chemistry that engage in professional development, enjoy teaching, are interested in the learning process, and are innovative in their teaching methods. The class sizes, especially in the upper level courses, are relatively small maximizing the student-instructor interaction. Students gain valuable hands-on experience with instrumentation in the laboratory although improvements can be made in updating and maintaining the instrumentation routinely used in the classroom. The new Shimadzu core facility increases the range of instruments available to the programs and could potentially be used to augment the students' experience in the instrumental analysis course. A small percentage of the students are given the opportunity to engage in an independent research experience as well as the opportunity to present their work at a professional meeting greatly improving their competitiveness in a tight job market. Because research mentorship is a time intensive activity and because faculty are generally not compensated for their work in this area, few opportunities exist for students to engage in this valuable experience. Improvements can also be made in promoting the programs and in building relationships with employers.

Biochemistry-Kim Colvert

Dr. Adsmond comments mostly apply to the Biochemistry program as well though there are a few additional points to be made. First, until recently only one Biochemist was available to teach the program specific courses. It is never a good idea for a program to be dependent on one faculty member. We now have a second Biochemist in the Department who will be fully integrated into the program. This raises my rating a bit. Second, the Biotechnology program is an important user of our courses, shares space and equipment and provides excellent students to the biochemistry courses. This helps us keep our standards high and our classes equipped and populated. How I rate the program depends largely on the standard to which it is being compared. For content it falls somewhere in the middle of other BA Biochemistry programs, lacking the breadth of courses available in larger institutions. I believe it offers an important science degree alternative at Ferris and has quality if not quantity. All Biochem majors interested in research have had the opportunity but that is due to small numbers of majors. Increases in program numbers would tax faculty, space and funding. Like Chemistry, program promotion can be improved. On the whole I would rate the program 84 out of 100.

18. Implementation of Findings

Among other things, this review has clarified the need for increasing the visibility of the Chemistry and Biochemistry programs at Ferris. This may be done in several ways:

Highlighting the many strengths of our programs on the Ferris website.

Reaching out to the employers of our graduates to gain valuable feedback on the performance of our alumni, communicate the strengths of our programs; and highlight our instrument needs.

Composing and distributing a newsletter to our alumni and their employers as a way of a) maintaining connection; b) highlighting the accomplishments of the students, faculty, and administrators associated with the program; and c) broadcasting our needs.

Partnering with the development officer of the College of Arts and Sciences to better advertise our programs.

Our collection and analysis of assessment data has begun, but at this point the quality and quantity of data is not high enough for us to draw many conclusions. We will continue to expand the scope of our collection of meaningful data both in the high enrollment lower level classes and in the senior level majors courses and will use the data to inform changes in our methods.

We will continue to explore ways in which we can help our students to develop the critical thinking, communication, and teamwork skills that employers seek.

And finally, we will continue to seek out resources in support of the independent research experiences that play such a critical role in the education of future chemists.

Appendix I
Program Check Sheets

ID: Name:

BIOCHEMISTRY MAJOR
BACHELOR OF ARTS

FERRIS STATE UNIVERSITY

Major Advisor: Dr. Kim Colvert

PHONE: (231) 591- 5851 OFFICE: ASC 3098 E-MAIL: colvertk@ferris.edu

Admission requirements: First year student admission is open to high school graduates (or equivalent) who demonstrate appropriate academic preparedness, maturity and seriousness of purpose. High school courses and grade point average, ACT composite score, and ACT Mathematics and Reading sub scores will be considered in the admission and course placement process. Transfer students must have at least 12 credits at the time of application with a minimum of 2.0 overall GPA including an English and mathematics course or they will be considered as first year students.

Graduation Requirements:

1. Minimum 2.0 CUMULATIVE grade point average in all courses.
2. No grade lower than a "C" in coursework included in the minimum 30 credit "major"; 15 credits must be FSU credits; 15 credits must be 300/400 level.
3. Must complete an approved academic minor.
4. 120 minimum semester credits including general education requirements
5. Residency requirement: 30 minimum FSU credits
6. Minimum of 40 credits numbered 300 or higher

Number of 300+ Credits: _____

Courses required for students entering this major Fall Semester 2015

REQUIRED		COURSE TITLE – FSU PREREQUISITES SHOWN IN BRACKETS ( )		FSU S.H.	GRADE
MAJOR: Minimum 59 credits – No grade lower than "C" (2.0) allowed to apply toward this major.					
BIOL	121	General Biology 1 (F, Su)	(CHEM 121 concurrent)	4	
BIOL	122	General Biology 2 (Sp, Su)	(BIOL 121 Min. C- and CHEM 121)	4	
BIOL	375	Principles of Genetics (F, Sp, Su)	(BIOL 122)	3	
CHEM	121	General Chemistry 1	(Prior Chemistry and MATH 115)	5	
CHEM	122	General Chemistry 2	(CHEM 121, MATH 115)	5	
CHEM	321	Organic Chemistry 1	(CHEM 122)	5	
CHEM	322	Organic Chemistry 2	(CHEM 321)	5	
CHEM	332	Biochemistry Lab 1	(CHEM 322, co – CHEM 364)	2	
CHEM	333	Biochemistry Lab 2	(CHEM 332)	2	
CHEM	364	Biochemistry	(CHEM 332)	4	
CHEM	451	Intro to Physical Chemistry	(CHEM 322, Phys 212 or 242,MATH 220)	4	
CHEM	474	Advanced Biochemistry	(CHEM 364, BIOL 375 & CHEM 231 or CHEM 451)	3	
MATH	220	Analytical Geometry and Calculus 1	(MATH 126 or MATH 130 or by placement)	4	
Choose one PHYS sequence:		PHYS 211 Introductory Physics 1 and PHYS 212 Introductory Physics 2 OR PHYS 241 General Physics 1 and PHYS 242 General Physics 2	(MATH 116 or MATH 120 or by placement) (PHYS 211) (MATH 220) (MATH 230 and PHYS 241)	4 4 5 5	
Academic Minor: An academic minor of 18 – 24 credits is required, any approved minor is allowed (except teacher education minors). Students should consult their major advisor if uncertain as to an appropriate minor to select. For graduation, both the academic minor clearance form and this major audit form must be attached to the graduation application.					
Bachelor of Arts Core: 3 – 15 credits: 1) proficiency in a foreign language through the 201 level (third semester), this may be accomplished through any combination of approved assessment and course work; 2) COMM requirement, choose a second COMM course from the list of options required for general education (COMM 105, 121 or 221).					

Electives to the minimum 120 credits required for this degree.				

GENERAL EDUCATION REQUIREMENTS

Courses which qualify in the Scientific Understanding (Z), Cultural Enrichment (C) and Social Awareness (S) categories are delineated in the General Education section of the FSU electronic catalog:
http://www.ferris.edu/htmls/academics/gened/courses.html

A. COMMUNICATION COMPETENCE 12 Sem Credits		
Course	Grade	Credits
ENGL 150		3
ENGL 250		3
ENGL 311 or 321 or 323 or 325		3
Choose one: COMM 105 COMM 121 COMM 221		3
TOTAL		

B. SCIENTIFIC UNDERSTANDING 7 Sem Credits
This requirement is achieved in the program major.

C. QUANTITATIVE SKILLS
This requirement is achieved in the program major.

D. CULTURAL ENRICHMENT 9 Sem Credits		
Only approved "C" courses may count toward this category, excluding foreign languages numbered 101, 102, 201. Requirements: 1) one course must be 200+ level, 2) maximum 5 credit hours of music and/or theater activities may apply.		
Course	Grade	Credits
200+ level course		3
TOTAL		

E. SOCIAL AWARENESS 9 Sem Credits		
Only approved "S" courses may count toward this category Requirements: 1) two different subject areas including at least one "foundation" course, 2) one course at the 200+ level		
Course	Grade	Credits
Foundation		
200+ level		
TOTAL		

F. GLOBAL CONSCIOUSNESS: Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.
Course:

G. RACE/ETHNICITY/GENDER: Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.
Course:

Sample Course Sequence: The following chart depicts one strategy to begin the program requirements. In order to complete this program in a four year plan, students must average 15 – 16 credit hours per semester. Students MUST consult their faculty advisor to develop a course sequence plan appropriate to their academic development and educational plans.

FIRST YEAR

Fall Semester		**Spring Semester**	
ENG 150 or COMM	3	COMM or ENGL 150	3
CHEM 121	5	CHEM 122	5
BIOL 121	4	BIOL 122	4
MATH by placement	3 - 5	MATH or general education elective	3 - 5
	15 - 17		15 - 17

NOTICE REGARDING WITHDRAWAL, RE-ADMISSION AND INTERRUPTION OF STUDIES
Students who return to the university after an interrupted enrollment (not including summer semester) must normally meet the requirements of the curriculum which are in effect at the time of their return, not the requirements which were in effect when they were originally admitted.

ID: Name:

CHEMISTRY MAJOR
BACHELOR OF ARTS

Form D Proposed Check Sheet

FERRIS STATE UNIVERSITY

MAJOR ADVISOR: Dr. Dan Adsmond

Phone: (231) 591-5867 Campus Address: ASC 3009 E-mail: adsmondd@ferris.edu

Admission requirements: First year student admission is open to high school graduates (or equivalent) who demonstrate appropriate academic preparedness, maturity and seriousness of purpose. High school courses and grade point average, ACT composite score, and ACT Mathematics and Reading sub scores will be considered in the admission and course placement process. Transfer students must have at least 12 credits at the time of application with a minimum of 2.0 overall GPA including an English and mathematics course or they will be considered as first year students.

Graduation Requirements:

1. Minimum 2.0 CUMULATIVE grade point average in all courses
2. No grade lower than a "C" in coursework included in the minimum 30 credit "major"; 15 credits must be FSU credits; 15 credits must be 300/400 level
3. Must complete an approved academic minor
4. 120 minimum semester credits including general education requirements
5. Residency requirement: 30 minimum FSU credits
6. Minimum of 40 credits numbered 300 or higher (excluding community college credits)

Number of 300+ Credits: _____

Courses required for students entering this major Fall Semester 2012

REQUIRED		COURSE TITLE – FSU PREREQUISITES SHOWN IN BRACKETS ( )		FSU S.H.	GRADE
Major: Minimum 47 credits. No grade lower than "C" (2.0) allowed to apply toward this major					
CHEM	121	General Chemistry 1	(Prior Chemistry and MATH 115)	5	
CHEM	122	General Chemistry 2	(CHEM 121)	5	
CHEM	231	Quantitative Analysis	(CHEM 122)	4	
CHEM	321	Organic Chemistry 1	(CHEM 122)	5	
CHEM	322	Organic Chemistry 2	(CHEM 321)	5	
CHEM	451	Introduction to Physical Chemistry	(CHEM 322, PHYS 212 or 242, MATH 220)	4	
MATH	220	Analytical Geometry and Calculus 1	(MATH 126 or MATH 130 or by placement)	5	
Choose one PHYS sequence:		PHYS 211 Introductory Physics 1 and PHYS 212 Introductory Physics 2 OR PHYS 241 General Physics 1 and PHYS 242 General Physics 2	(MATH 116 or MATH 120 or by placement) (PHYS 211) (MATH 220) (MATH 230 and PHYS 241)	4 4 5 5	
CHEMISTRY MAJOR ELECTIVES: Select a minimum of 6 credits from:					
CHEM	317	Instrumental Analysis	(CHEM 231, concurrent with CHEM 322)	3	
CHEM	364	Biochemistry	(CHEM 322)	4	
CHEM	381	Inorganic Chemistry	(CHEM 321)	3	
Academic Minor: An academic minor of 18 – 24 credits is required, any approved minor is allowed (except teacher education minors). Students should consult their major advisor if uncertain as to an appropriate minor to select. For graduation, both the academic minor clearance form and this major audit form must be attached to the graduation application.					
Electives to the minimum 120 required for this degree.					
Bachelor of Arts Core: 3 – 15 credits: 1) proficiency in a foreign language through the 201 level (third semester), this may be accomplished through any combination of approved assessment and course work; 2) COMM requirement, choose a second COMM course from the list of options required for general education (COMM 105, 121 or 221)					

GENERAL EDUCATION REQUIREMENTS

Courses which qualify in the Scientific Understanding (Z), Cultural Enrichment (C) and Social Awareness (S) categories are delineated in the General Education section of the FSU electronic catalog:
http://www.ferris.edu/htmls/academics/gened/courses.html

I. GENERAL EDUCATION REQUIREMENTS

A. COMMUNICATION COMPETENCE 12 Sem Credits

Course	Grade	Credit
ENGL 150		3
ENGL 250		3
ENGL 311 or 321 or 323 or 325		3
Choose one: COMM 105 COMM 121 COMM 221		3
	TOTAL	

B. SCIENTIFIC UNDERSTANDING 7 Sem Credits

This requirement is achieved in the program major.

C. QUANTITATIVE SKILLS

This requirement is achieved in the program major.

D. CULTURAL ENRICHMENT 9 Sem Credits

Only approved "C" courses may count toward this category, excluding foreign languages numbered 101, 102, 201. Requirements: 1) one course at the 200+ level, 2) maximum 5 credit hours of music and/or theater activities may apply

Course	Grade	Credit
200+ level course		3
	TOTAL	

E. SOCIAL AWARENESS 9 Sem Credits

Only approved "S" courses may count toward this category. Requirements: 1) two different subject areas including at least one "foundations" course, 2) One course at the 200+ level

Course	Grade	Credit
Foundation		
200+ level		
	TOTAL	

F. GLOBAL CONSCIOUSNESS: Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.

Course:

G. RACE/ETHNICITY/GENDER: Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.

Course:

Sample Course Sequence: The following chart depicts one strategy to begin the program requirements. In order to complete this program in a four year plan, students must average 15 – 16 credit hours per semester. Students MUST consult their faculty advisor to develop a course sequence plan appropriate to their academic development and educational plans.

FIRST YEAR

Fall Semester

ENGL 150 or COMM	3
CHEM 121	5
MATH (by placement)	3 - 5
Foreign Language or gen ed elective	3 - 4
	14 - 17

Spring Semester

ENGL 150 or COMM	3
CHEM 122	5
MATH or general education elective	3 – 5
Foreign Language or gen ed elective	3 - 4
	14 - 17

WITHDRAWAL, RE-ADMISSION AND INTERRUPTION OF STUDIES

Students who return to the university after an interrupted enrollment (not including summer semester) must normally meet the requirements of the curriculum which are in effect at the time of their return, not the requirements which were in effect when they were originally admitted.

Appendix II
Course Syllabi

Chemistry 121 (5 credit hours)
General Chemistry I (Spring 2015)
Dr. Francis M. Burns

Office: ASC 3096

Telephone: 231-591-2596

email: burnsf@ferris.edu

Lecture (SCI 102): M – R, 6:00 PM – 6:50 PM

SLA (TBA) - Sections 212 & 213 ONLY:
T and R, 7:00 - 8:15 PM

Laboratory:
211: R 3:00 – 5:50 (SCI 333)
212: R 8:00 – 10:50 (SCI 333)
213: W 3:00 – 5:50 (SCI 333)
214: T 3:00 – 5:50 (SCI 314)

Office hours: Mondays 3:00 – 4:50 pm; Thursdays 12:00 – 1:50 pm; or by appointment

No disruptive electronic devices or behavior is permitted. Cellular telephones must be turned off during lecture. The use of graphing calculators and/or cell phones is not permitted during exams.

Prerequisites: Completion of CHEM 103 with a grade of C- or better OR 1 year of high school chemistry; AND completion of MATH 110 with a grade of C- or better OR ACT 19 OR SAT 460.

Course Description: Fundamental principles, laws, and theories of general chemistry, including stoichiometry, gas laws, thermochemistry, atomic structure, chemical bonding, periodicity, liquids and solids, solution chemistry, and theories of acid and bases. Concurrent laboratory/workshop sessions will include exercises illustrating the principles discussed in lecture. Students who anticipate enrolling in chemistry courses at the 200-level or higher should take this course. This course meets General Education requirements: Scientific Understanding, Lab.

Outcomes:

General Education Outcomes: This course fulfills the general education requirement for Scientific Understanding. A student succeeding in this course should:

1. have a working knowledge of the fundamental principles of chemistry;
2. be able to use appropriate scientific reasoning skills to interpret and analyze content in chemistry;
3. have a basic understanding of the scientific method, scientific concepts, and the evolution of scientific ideas;
4. have a more positive attitude toward science and an increased confidence in their ability to understand science.
5. will recognize that:
   a. the physical universe is understandable.
   b. scientific ideas are not static, but rather dynamic and change over time.
   c. scientific principles are testable.
   d. scientific knowledge is based on a vast number of observations.

Specific Course Outcomes: Upon completion of this course, a student can:

1. apply the scientific method to solve chemical problems, interpret chemical phenomena, and propose reasonable explanations..
2. carry out unit and molar conversions in stoichiometric problems.
3. use the periodic table to organize and correlate electronic structure, properties, and reactivity of elements and compounds.
4. name and identify simple inorganic molecules and draw their overall geometry.
5. explain the nature and properties of matter, including the type of attractions, from a macroscopic and atomic perspective.
6. identify different types of chemical reactions and write various forms of balanced equations for reactions in aqueous solution..
7. calculate enthalpy changes of reaction using calorimetry data, standard enthalpies of formation, Hess's Law, and bond energies.

Additional Outcomes: Upon completion of this course, a student will make progress with:

1. Developing skill in expressing oneself orally or in writing.

Required Material:

Text book:	*Chemistry: The Central Science 12th Edition* by Brown, LeMay, Bursten, Murphy, and Woodward (ISBN 978-0-321-69672-4)
Mastering Chemistry:	Access license for online homework is typically purchased as part of a textbook package or separately (can be purchased at the website). Course ID = MCBURNS52639
NON-programmable Calculator	Required for tests and laboratory sessions. **No graphing calculator or cell phone will be permitted during tests. Sharing calculators is strictly forbidden during tests!**
Laboratory Manual:	*Laboratory Workbook for Chemistry 121 & 122*
Clicker:	Turning Point clicker is available through the bookstore or company.
Eye protection:	CHEMICAL Splash - proof goggles must be used by students (not glasses). Goggles possessing screens or damaged, such as the removal of plastic vents, may not be used in the laboratory.

Recommended Material:

Study guide:	ISBN 978-0-321-70458-0
Selected Solutions manual:	ISBN 978-0-321-90323-5
Homework problem notebook:	

Course Expectations and Policies:

1. **Course Expectations:** "Ferris State University values education that is career-oriented, balances theory and practice, develops critical thinking, emphasizes active learning, and fosters responsibility and the desire for the lifelong pursuit of knowledge."
   - Students MUST come to lecture prepared to actively participate: review sample exercise videos, complete reading quizzes, outline the topic(s) to be covered, developing a vocabulary list, write down sample questions and/or questions.
   - I expect students to contribute to lecture by asking questions, contributing information/answers, and listening.
   - Students must bring their scientific calculator to each lecture. I expect students to actively work problems, and supply their answers, if called upon.
   - I assign sufficient work that students should expect to spend 2 to 3 hours per lecture/laboratory hour or approximately 14 to 21 hours per week.

2. **Laboratory Attendance Policy:** Attendance is mandatory, but I don't distinguish between "excused" or "unexcused" absences. Students should arrive at lab ready to learn at the beginning of class, but tardiness will not be penalized unless it becomes a problem. Students may only leave early after completing their experiment and/or permission from the instructor. Otherwise, they may be marked absent. A missed laboratory session is a missed educational opportunity that negatively affects both the student AND the rest of the class. Students suffering from a chronic health condition or other extenuating circumstances should contact me as soon as possible. **You must pass laboratory with a "C" (73.00%) or better in order to receive a passing grade.**

3. **Lecture Attendance Policy**: Attendance is **MANDATORY** for all lectures– it is your responsibility to "sign-in." Tardiness may result being marked, "absent." Students may only leave lecture early only with permission from the instructor. Otherwise, they will be marked absent. Students are responsible for all material presented in lecture, including any material not covered in the textbook. Missing more than three lectures will result in losing one percentage point in the final course average for each missed lecture above three. For example, a student's final average is 83.12% (B), but missed four lectures and earns an 82.12% (B-). If you miss a class, it is <u>your</u> responsibility to obtain any notes, handouts, assignments, and announcements presented in class from another classmate.

4. **Structured Learning Assistance (SLA) Program Policy.** No more than four (4) absences from the required workshop sessions will be permitted during the semester.
   - ALL SLA students are required workshop meetings until test #1 has been given and a baseline grade has been established.
   - Once Test #1 has been given, students are excused from the workshop, if they have earned a cumulative course percentage of 90% or better. Of course, excused students are encouraged to continue to attend workshops.
   - Students whose cumulative course percentage is less than 90% after Test #1 are required to attend all workshops until their cumulative grade improves to 90% or better.
   - It is the student's responsibility to find out whether he or she is required to attend workshops. A student needs to check his or her online grade. I will endeavor to update them after each semester test.
   - Students must observe all of the policies detailed in the SLA Attendance and Workshop Policy handout.

5. **Missed Assignments/Tests**
   - **Semester tests:** Students missing a semester test will NOT be given any make-up test. The missed test's grade will be obtained from the corresponding portion of the comprehensive final exam.
   - **Quizzes**: Students missing a quiz will NOT be given any make-up.
   - **Laboratory:** Lab make-ups are not guaranteed for students. All make-ups need instructor approval. Students missing a laboratory session will be given a 0 for the missed work. In event that a laboratory session is canceled due to weather or instructor illness, students assigned to the canceled session will be excused from the missed work. All other students will be expected to attend their respective laboratory sessions.
   - **Assignments/laboratory reports:** Students may submit late assignments for partial credit (20% deduction).

Academic Misconduct: If sufficient evidence is obtained that a student is engaging in academic misconduct (See FSU Student Handbook). He or she will receive a "zero" for the assignment or test. In addition, the student will be referred to the university Judicial Committee.

Cheating: Books, papers, and notes of any kind are prohibited during exams and quizzes. If a student is caught cheating on an exam or quiz, they will fail the test or quiz (and possibly the course). The presence of a cell phone during a test will also result in an immediate failure of a test. Students are allowed to have a NON-PROGRAMMABLE calculator, writing utensils, and a periodic table. Sharing a calculator during a test is never allowed. Talking or communicating during a test with people inside or outside the classroom is not allowed.

Disruptive Behavior An instructor has an obligation to maintain order in his or her class for other students. Toward that end, an instructor is authorized and expected to inform a student that his or her behavior is disrupting a class and to instruct the student to stop that behavior. If the student persists, the instructor is authorized to direct the student to leave the class. If the student fails to comply with a directive to leave the class, the instructor may call Public Safety to assist with the student's removal.

Grading:

- I used a "weighted" average for calculating grades. As a result, a point earned on a test is "weighted" more heavily than a point earned in laboratory or for writing assignments. Simply adding up all of your points and dividing by the total possible points is VERY incorrect!

Laboratory Experiments 10%
- 13 experiments
- The lowest laboratory report score will be dropped from the overall grade average.

Assignments 10%
- Mastering Chemistry (http://Mastering Chemistry.com)
- Writing Assignments (Ferris Connect)

Class Participation 5%
- Turning point clicker

Quizzes (approximately 10 points/quiz) 10%
- A weekly quiz will be given on the first lecture of the week, covering the prior week's material. The two lowest quiz scores will be dropped from the overall grade average.

Tests/Quizzes (approximately 100 points/test) 55%
- Tests will NOT be curved due to a low class average, BUT students performing better on the corresponding portion of the comprehensive final exam will have the better grade used for their final grade calculation. For example, a student earned a 51.5%, but the corresponding questions on the final exam produced an average of 63.0% - the better grade is used for the final grade.
- An Extra Credit Quiz will be given the week following a semester test.

Final Exam (ACS comprehensive exam) 10%

Weighting the point totals in the above categories by their percentage will determine your final grade. Extra credit points will be added to the Test category, increasing their effect on your grade. In addition, the ACS comprehensive exam will be curved to minimize its effect on the *median* course grade.

After the calculation of students' overall course average, the following scale will be used for assigning final grades. I reserve the right to adjust the grade scale at the end of the semester.

Grade Scale:

A	100-93.00%	B-	82.99-80.00%	D+	69.99-67.00%
A-	92.99-90.00%	C+	79.99-77.00%	D	66.99-63.00%
B+	89.99-87.00%	C	76.99-73.00%	D-	62.99-60.00%
B	86.99-83.00%	C-	72.99-70.00%	F	< 60.00

During the semester, I will post the points earned from individual assignments, and the overall grade average of each student on Ferris Connect. I recommend that you verify the posted grades – errors do occur in spite of my effort to accurately record scores. In addition, I recommend that you calculate your overall average. Use the following formula:

$$Overall\ Average = \frac{\left[\begin{array}{c}(lab\ average * 0.10) + (homework\ average * 0.10 + (class\ participation * 0.05) + \\ (quiz\ average * 0.10) + (test\ average * 0.55)\end{array}\right]}{(0.10 + 0.10 + 0.05 + 0.10 + 0.55)}$$

Suppose a student had the following averages: laboratory – 95.1%, writing – 75.0%, homework – 95.3%, participation – 95.0%, quizzes – 63.2%, and tests – 77.3%. Her 80.58% overall average is calculated:

$$80.58\% = \frac{\left[\begin{array}{c}(95.1\% * 0.10) + (95.3\% * 0.10 + (95.0\% * 0.05) + \\ (62.3\% * 0.10) + (77.3\% * 0.55)\end{array}\right]}{(0.15 + 0.15 + 0.05 + 0.10 + 0.55)}$$

Important Dates

Classes begin	Monday, January 12
Martin Luther King Day (no classes)	Monday, January 19
Midterm grades due	Monday, March 9
Last day to drop class for "W" grade	Friday, March 27
Spring recess (no classes)	Saturday, March 7 – Sunday, March 15
Mid-term recess (no classes)	Thursday, April 2 – Sunday, April 4
Last day of classes	Friday, May 1
Final Examinations Begin	Monday, May 4

Test Dates

- Test dates will be not changed, except for extraordinary circumstances (e.g., university closing due to weather)

➢ Test 1 – Wednesday, February 4, 2015

➢ Test 2 – Wednesday, March 18, 2015

➢ Test 3 – Monday, April 27, 2015

➢ Final Exam – Tuesday, May 5: 6:00 to 7:40 pm

➢ Make-Up Final Exam – Friday, May 8: 10:00 to 11:40 am

- To be eligible for a make-up exam, a student must have three or more final examinations on the same day or a conflict with a mass examination. See http://www.ferris.edu/admissions/registrar/schdbook/page12-13.htm for more information.

CHEM 121 – TENTATIVE COURSE SCHEDULE

Week	Monday	Tuesday	Wednesday	Thursday
1	**January 12** ACS Pretest	**January 13** Dry lab session →	**January 14**	**January 15**
2	**January 19** MLK Day **NO CLASSES**	**January 20** Exp 2 →	**January 21**	**January 22**
3	**January 26**	**January 27** Exp 3 →	**January 28** Chap 3	**January 29**
4	**February 2**	**February 3** Exp 5 →	**February 4** **Test 1**	**February 5** Chap 4
5	**February 9**	**February 10** Exp 9 →	**February 11** **EC Quiz 1**	**February 12**
6	**February 16**	**February 17** Exp 12 →	**February 18**	**February 19**
7	**February 23**	**February 24** Exp 6 →	**February 25**	**February 26** Chap 6
8	**March 2**	**March 3** Exp 8 →	**March 4**	**March 5**
	Spring Break – No Classes (Mid-term grades due March 9)			
9	**March 16**	**March 17** Exp 14 →	**March 18** **Test 2**	**March 19**
10	**March 23**	**March 24** Handout 1 →	**March 25** **EC Quiz 2**	**March 26**
11	**March 30**	**March 31** **NO LAB**	**April 1** **NO LAB**	**April 2** Mid-semester Break **NO CLASSES**
12	**April 6**	**April 7** Handout 2 →	**April 8**	**April 9**
13	**April 13**	**April 14** Handout 3 →	**April 15**	**April 16**
14	**April 20**	**April 21** Exp 13 →	**April 22**	**April 23**
15	**April 27** **Test 3**	**April 28** Lab Checkout →	**April 29**	**April 30** **EC Quiz 3**

CHEM 122 – General Chemistry 2 **Spring 2015**

Instructor	Office	Phone	E-mail
Dr. Mark Thomson	ASC 3007	(231) 591-5895	MarkThomson@ferris.edu
Office Hours	MTRF	1:00-1:45	
	W	9:00-10:00	
	and by appointment		

Lecture MTRF 2:00-2:50 SCI 120

Lab

Section 231	Friday	9:00 – 11:50	SCI 333	SLA	TR 3:00-4:15 STR 235
Section 232	Wednesday	12:00 – 2:50	SCI 333	SLA	TR 3:00-4:15 STR 235
Section 233	Monday	9:00 – 11:50	SCI 333		

Course Description: Continuation of CHEM 121, including oxidation-reduction reactions, electrochemistry, chemical equilibrium, chemical kinetics, nuclear chemistry, thermodynamics, and descriptive chemistry of metals and nonmetals. Laboratory will involve some experiments illustrating topics discussed in lecture along with several sessions devoted to the qualitative analysis of common cations and anions. This course meets General Education requirements: Scientific Understanding, Lab. Pre-Requisites: MATH 115 with a grade C-/better or ACT 24 or SAT 560; & CHEM 121 with a grade C- or better.

Course Outcomes: In this course, students will be expected to:

a) apply common theories of acids and bases to describe relevant species in acidic solutions, basic solutions, and buffers.
b) integrate diverse concepts in chemical kinetics, redox reactions and electrochemistry, and the chemistry of the elements and apply them to new and unknown problems.
c) identify common radioactive particles and describe their role in basic nuclear reactions.
d) apply appropriate thermodynamic factors to determine the spontaneity of a process.
e) apply theoretical models of reaction rates to the use of rate laws and the description of possible reaction mechanisms.
f) describe at a molecular level what takes place when physical or chemical systems come to equilibrium, interpret diagrams or graphs representing such systems, and calculate concentrations of species in reactions that have come to equilibrium.
g) design and perform lab experiments and interpret data.

General Education Course Outcomes: Upon completion of this course, a student will:

1. have a working knowledge of the fundamental principles of chemistry.
2. be able to use appropriate scientific reasoning skills to interpret and analyze content in the natural sciences.
3. have a basic understanding of the scientific method, scientific concepts, and the evolution of scientific ideas.
4. have a more positive attitude toward science and an increased confidence in their ability to understand science.
5. will recognize that:
   a. the natural world is understandable.
   b. scientific ideas are not static, but rather dynamic and change over time.
   c. scientific principles are testable.
   d. scientific knowledge is based on a vast number of observations.

Materials Required:

Chemistry: The Central Science, 12th Ed., Brown et al. (ISBN 978-0-321-69672-4)

CHEM 122 Lab Manual v. 2

Access to www.MasteringChemistry.com

Course Name – Thomson CHEM 122 Spring 2015

Course ID – MCTHOMSONSPRING2015

Non-programmable Scientific Calculator – You will be expected to have a scientific calculator and to know how to use it (ask before the exam if you do not know how). Make sure your calculator is in good working order before each exam. Calculators will NOT be shared during an exam for any reason.

Lab Notebook – You will be expected to keep a bound lab notebook where you will be expected to record your observations and lab work. This will be a bound composition book and NOT a spiral or a 3-ring notebook.

Safety Goggles – You will be expected to bring a pair of safety goggles to class each and every lab period. Required features will be discussed during the first day of lab and safety glasses or other substitutes will not be accepted. If you are not prepared to perform the lab safely, you will not be allowed to complete the experiment. This includes the proper dress code that will also be discussed the first week of class.

Course Evaluation:

Homework Assignments and Quizzes: There will be regularly scheduled on-line homework assignments and quizzes posted at http://www.MasteringChemistry.com. Access and use of this website which accompanies the textbook will be discussed the first week of class. Each homework assignment or quiz will be available for about 7 days and it will be the student's responsibility to make sure that they access the website and complete the assignment before the deadline. No late work will be accepted. Additional homework assignments and quizzes may be given in class as needed. All homework assignments and quizzes will be totaled at the end of the semester and scaled to a total possible value of 200 points.

Lab Reports and Lab Notebooks: There will be a total of 14 experiments conducted in lab during the semester (see schedule). Each of these experiments will result in a lab report with a due date that will be announced in lab. Each Lab Report will be worth 10 points. The lab notebook will be worth an additional 5 points each week. Lab reports may be submitted late (up to one week late) for half credit. **The best 13 lab report and notebook grades will be recorded and included in the calculation of the final grade.** Attendance in lab is MANDATORY. If you miss more than two labs, you will AUTOMATICALLY FAIL. Make-up scheduling of a missed lab may be available at another time during the week the scheduled lab is missed, based on available space. If you know you will be missing a lab, notify the instructor as soon as possible.

Exams: There will be three exams worth 100 points each. The dates, which are tentatively listed in the schedule, are February 5, March 3, and April 14.

Final Exam: The Final Exam will be worth 200 points. The final exam will be **comprehensive**, including topics from previous exams as well as new material covered after Exam #3. It is scheduled for Wednesday, May 6, 2015 at 2:00.

The Final Grade will be determined as follows, based on a total of 895 possible points.

A = average between 90% and 100%.

B = average between 80% and 89%.

C = average between 70% and 79%.

D = average between 60% and 69%.

F = average below 60%.

Course Requirements and Policies:

Lab Safety: Working with chemicals of any kind is hazardous. Lab safety is always a community issue and your safety in the lab is dependent on your actions as well as the actions of those around you. **The first key to lab safety is to come properly prepared. This includes proper eye protection as discussed on the first day of class. This also includes dressing properly. In chemistry lab, you should not wear shorts, open-toed shoes, halter tops, or other clothing that does not offer sufficient protection.** The next key to a safe lab is to keep your work area free of clutter and obstruction. You will be sharing lab space with several other students and several other classes. Because of this, it is imperative that you clean your glassware and supplies and return them to their storage locations. Failure to do so will result in a grade penalty.

Behavior Policy: Free discussion, inquiry, and expression are encouraged in this class. Classroom behavior that interferes with either (a) the instructor's ability to conduct the class or (b) the ability of students to benefit from the instruction is not acceptable. Examples may include routinely entering class late or departing early; use of beepers, cellular telephones, or other electronic devices; repeatedly talking in class without being recognized; talking while others are speaking; or arguing in a way that is perceived as "crossing the civility line." In the event of a situation where a student legitimately needs to carry a beeper/cellular telephone to class, prior notice and approval of the instructor is required.

Attendance Policy: Attendance is expected. In this course, a student will be considered absent if they miss more than half the scheduled class period. It is understood that emergencies might come up suddenly. If possible, let the instructor know beforehand that you will be missing class.

Students are allowed to miss up to 6 lecture classes without penalty for any reason, excused or unexcused. Be careful and try to avoid problems at the end of the semester. Each additional absence will result in a 5% reduction in your final overall grade. The instructor reserves the right to make allowances in the event of extreme cases involving extended hospitalization or severe calamity.

Lab experiments are particularly participatory in nature and making up the material is not usually possible. Students are allowed to miss one lab without additional penalty as they are allowed to drop one lab report. An additional lab may be missed with a grade of zero for that report. Missing more than two labs will result in a failing grade for the course.

E-mail and On-Line Communication Policy: I will do my best to check my e-mail account regularly and often. During the week (Monday-Friday), you should be able to expect a reply within 12-18 hours. On weekends, please recognize that I may be less connected to my accounts and a response may take 24-48 hours. You should be in the habit of checking FerrisConnect frequently. I will post general announcements and assignments there and you will be responsible for knowing about these things.

Inclement Weather Policy: The University remains open for classes unless officially decided otherwise. Decisions regarding campus closure are posted on the University web page. If necessary, announcements will also be posted on-line regarding work missed and rescheduled assignments or exams. Use your own best judgment if traveling from an off-campus site and let me know as soon as possible if weather conditions prevent you from attending class.

Students with Special Needs: I wish to provide all students in this course with the best opportunity to learn the material. Any student who feels they may need an accommodation based on the impact of a disability should contact me to discuss their specific needs. Any reasonable and appropriate accommodations should be discussed prior to the first exam. Please also contact the Disabilities Services Office, STR 313, (231)591-3057 to coordinate reasonable accommodations for documented disabilities.

The instructor reserves the right to modify this syllabus if necessary during the course of the semester. Any such changes will be discussed in class and posted in writing on FerrisConnect.

CHEM 122 – General Chemistry 2 **Spring 2015**
Tentative Schedule

Chemical Equilibria	(Chapter 15)
LeChâtelier's Principle	
Equilibrium constant expressions and calculations	
Acids, Bases, and Salts	(Chapter 16 & 17)
Dissociation constants, K_a and K_b	
Titrations	
Buffer solutions and calculations	
Exam 1 – February 5, 2015	
Coordination Chemistry	(Chapter 16 & 23)
Lewis Acids and Bases	
Complex ion formation	
Structure and Isomerization	
Applications	
Solubility	(Chapter 17)
Solubility rules revisited	
Solubility product constant, K_{sp}	
Common ion effect	
Thermodynamics	(Chapter 19)
Entropy, enthalpy, and Gibb's free energy	
Spontaneity and the position of equilibrium	
Energy diagrams	
Exam 2 – March 3, 2015	
Electrochemistry	(Chapter 20)
Oxidation reduction reactions	
Electrolysis and electrochemical cells	
Qualitative Inorganic Analysis	(Chapter 17)
General approaches and techniques	
Systematic approach to problem solving and analysis	
Kinetics	(Chapter 14)
Reaction rates and rate laws	
Reaction mechanisms and catalysis	
Exam 3 – April 14, 2015	
Nuclear Chemistry	(Chapter 21)
Spontaneous radioactive decay	
Nuclear reactions	
Applications of nuclear chemistry	
Other Selected Topics (Environmental Chemistry)	(Chapter 18)

Final Exam – Wednesday May 6, 2015 at 2:00 pm

CHEM 122 – General Chemistry 2 Tentative Laboratory Schedule Spring 2015

Monday	Tuesday	Wednesday	Thursday	Friday
January 12	January 13	January 14	January 15	January 16
Check In and Acid Base Titrations				
January 19	January 20	January 21	January 22	January 23
MLK Jr. Day	**Titration of a Diprotic Acid**			
January 26	January 27	January 28	January 29	January 30
(continued)	**Buffers**			
February 2	February 3	February 4	February 5	February 6
(continued)	**Complexation and Displacement Reactions**			
February 9	February 10	February 11	February 12	February 13
(continued)	**Solubility Product Constant**			
February 16	February 17	February 18	February 19	February 20
(continued)	**Vapor Pressure and Heat of Vaporization**			
February 23	February 24	February 25	February 26	February 27
(continued)	**Balancing Oxidation Reduction Reactions**			
March 2	March 3	March 4	March 5	March 6
(continued)	**Introduction to Qualitative Analysis**			
March 9	**March 10**	**March 11**	**March 12**	**March 13**
Spring Break				
March 16	March 17	March 18	March 19	March 20
Establishing a Table of Reduction Potentials				
March 23	March 24	March 25	March 26	March 27
Qualitative Analysis (continued)				**Rate Law Determination**
March 30	March 31	April 1	**April 2**	**April 3**
Rate Law Determination			**Easter Break**	
April 6	April 7	April 8	April 9	April 10
Activation Energy for a Chemical Reaction				
April 13	April 14	April 15	April 16	April 17
Make Up or TBD				
April 20	April 21	April 22	April 23	April 24
Environmental Chemistry				
April 27	April 28	April 29	April 30	May 1
Lab Checkout				
May 4	May 5	May 6	May 7	May 8
Final Exams				

CHEM 231
Quantitative Analysis
4 Credits

Instructor :	Dr. Prabhakara Shetty	Fall 2014
Office:	ASC 3097	STR 233
Telephone:	591 2589	MWF 10:00 to 10:50 AM
Office Hours:	TR 9:30 AM to 11:00 AM, F 9:00 AM to 10:00 AM	

General Goals and Objectives:

To enable students to understand the concepts of classical and modern quantitative analysis involving both wet and instrumental methods.

To develop the ability to draw reasonable inferences from observations, and to improve problem solving skills

Learning Outcomes and Assessment:

Learning outcomes will be assessed at the end of the semester using a cumulative final exam. At the end of the semester students are expected to:
(1) Understand statistical analysis of results from replicate trials and interpret the statistical data.
(2) Visualize multiple equilibria existing in strong/weak/polyprotic acid (or base) solutions and predict pH in different concentrations.
(3) Visualize multiple equilibia existing in chelating agent solutions and predict concentrations of different species under different conditions.
(4) Understand qualitative and quantitative aspects of matter-electromagnetic radiation interactions.
(5) Understand the principle of extraction and extrapolate to qualitative/quantitative analysis by chromatography.

This course meets the General Education requirement for Scientific Understanding.

Pre-requisite: CHEM 122 or equivalent

Requirements:

Four hourly tests	400 points (100 pts. each).
Weekly Quizzes	30 to 50 points
Final Exam	100 points (ACS test will be used)
Laboratory	120 points.

Grading Scale:

92.5 % and above	A
89.5 to 92.4 %	A-
86.5 to 89.4 %	B+
82.5 to 86.4 %	B
79.5 to 82.4 %	B-
76.5 to 79.4 %	C+
72.5 to 76.4 %	C
69.5 to 72.4 %	C-
66.5 to 69.4 %	D+
62.5 to 66.4 %	D
59.5 to 62.4 %	D-

Text book: Quantitative Chemical Analysis by Daniel C. Harris, 6th or 7th ed.

Laboratory Manual: Laboratory Manual for Chemistry 231

Topics:

1. Introduction to chemical analysis
2. Statistical approaches to error in analysis and data handling.
3. Chemical equilibrium: concept and calculations.
4. Acids, bases and buffers
5. Volumetric analysis: titrations and equivalence points.
6. gravimetric analysis: the limits of solubility
7. Complexometric Titrations: EDTA
8. Molecular spectroscopy.
9. Chromatography.
10. Electrochemistry (if time permitting).

Attendance Policy: If a student misses more than three lectures in a semester he/she loses one percentage point from the final numerical grade for each missed lecture. This is an SLA supported class, therefore, students who are required to attend SLA sessions accrue more than four absences will receive an 'F' as a final grade.

Policy on Tardiness: Students are expected to be on time, and stay till the end of the lecture. If a student comes in late or leaves early, he/she will be marked absent for that day. Due to health hazards associated with some of the chemicals used in the lab, if a student misses even a part of the pre-lab lecture, he or she will not be allowed to work in the lab that day.

This is a Structured Learning Assistance (SLA) supported course. SLA enhances student learning by combining successful learning strategies with activities designed to review lecture [, lab] and printed materials. On average, SLA supported sections have lower rates of failure and withdrawal than non-SLA sections and students who participate believe they score at least one half to one full letter grade higher in the course as a result of SLA.

The SLA meets:[TR 6 to 7:30 PM]. Attendance at SLA workshops is mandatory until the first [test/quiz/other assessment] on [September 27] at which time only students with a [grade/percent] below [90%, and average of all tests of 85%] will be required to attend. Students scoring [an average of 85%] or higher are encouraged to attend but are not required. Students will have the opportunity with each [test/quiz/ assessment] to change their SLA attendance status, and it is the students' responsibility to know their SLA attendance status. [Test results/Grades] will be posted [location and timing of communication of grades]. Students who are required to attend who accrue more than four unexcused absences in SLA must withdraw ('W') from the course if possible or receive an 'F' as a final grade.

Your facilitator will provide you with a copy of the SLA Attendance and Workshop Policies the first day of workshop. The SLA facilitator will thoroughly review this document, and students must sign the statement of understanding before participating. I fully support the SLA Attendance and Workshop Policies.

Tentative Test Schedule:

Final Exam	Dec 9, 14	10:00 AM to 11:40 AM	STR 233
Test # 1	Sept 17, 14	10:00AM to 10:50AM	STR 233
Test # 2	Oct 15, 14	10:00AM to 10:50AM	STR 233
Test # 3	Nov 5, 14	10:00AM to 10:50AM	STR 233
Test # 4	Dec 3, 14	10:00AM to 10:50AM	STR 233

Lab Schedule:

Check in and safety drill (week of August 25, 2014)
Week of September 1: No lab (Labor Day)
Experiment # 1, Making Measurements (week of September 8, 14)
Experiment # 2, Acid-Base Titrations (week of Sept 15, 14)
Experiment # 3,Determination of Acid-Neutralizing Strength of Antacids (Week of September 22 and 29, 2014)
Experiment # 4, Standardization of Thiosulfate (week of October 6, 2014)
Experiment # 5, Analysis of Vitamin C (week of October 13, 2014)
Experiment # 6, Gravimetric Analysis of Chloride (week of October 13 and 20, 2014)
Experiment # 7, Measuring pH (week of October 27, 2014)
Experiment # 8, Introduction to Spectrophotometry (week of Nov 3, 2014)
Experiment # 9, HPLC Analysis of Hydrocarbons (weeks of Nov 10 to Dec 1, 2014)
WEEK OF NOVEMBER 24: NO LABS (THANKS GIVING RECESS)
Experiment # 10, HPLC Analysis of Sugars (weeks of Nov 10 to Dec 1, 2014)
Experiment # 11, UV/VIS Analysis of a Binary mixture (weeks of Nov 10 to Dec 1, 2014)

CHEM 317 SPRING SEMESTER 2015

INSTRUMENTAL METHODS OF ANALYSIS

Mr. Bill Killian
Lecture: T, R 10-10:50 am
SCI-336

January 12, 2015
Spring Semester 2015
3 Credits

Lab: Sec. 211 W 12-3:50 pm SCI-321 Mr. James Weaver Lab Exercise Lab Book Killan/Weaver

Office Hours: T & R 8:00-10:00

Lecture Topics:

Data manipulation, graphing, units, sample preparation, methodology. Specific ion electrodes, pH, potentiometry. Refractometry, use of radiant energy in analysis. Traditional spectroscopy including uv-vis, and ir. Emission spectroscopy and atomic absorption techniques. Nuclear magnetic resonance, including ^{13}C, as well as mass spectrometry. Chromatography, special emphasis on gas chromatography.

Lab Topics:

Sample prep, statistics, potentiometric methods, specific ion electrodes, uv-vis spectroscopy, refractometry, viscometry, IR, NMR, C-13NMR, AA, mass spec, chromatography gas and liquid.

Requirements:

Final Exam	1x100=	100
Quizzes	4x 40=	160
Lab reports	=	240
Total		500 points

Grading:

>92%	A
90-92	A-
87-89	B+
83-87	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
<70	D

Other Considerations:

1. Problem sets will be assigned after each class and reading will be assigned.
2. Lab reports are to be typed with the form designated.
3. A lab notebook is required with attention paid to entries.
4. Attendance and your notes are essential.

Course Purpose:

An attempt will be made to cover important aspects of a number of instrumental techniques, emphasizing practical instrumental application to problems. Lab will be especially important in developing through "hands on" experiences, the fundamentals of instrument usage and application.

Course Objectives:

1. To become familiar with basic working instrumental theory of a survey of a number of common laboratory instruments.
2. To be able to solve problems related to these instruments, mathematical, as well as technical.
3. To gain expertise in instrument operation through laboratory exercises.
4. To be able to recognize, record, and analyze analytical instrumental data.
5. To be critically able to evaluate an instrument's performance and an analyst's performance.
6. To become independent in through and action while working open ended lab exercises.
7. To compile professional lab reports.
8. Above all...be a safe worker in the lab.

"Science is not technology, it is not gadgetry, it is not a great mechanical monster. Science is an adventure of the human spirit. It is essentially an artistic enterprise, stimulated largely by disciplined imagination, and based largely on faith in the reasonableness, order and beauty of the universe of which man is a part." Warren Weaver

Chemistry 321: Organic Chemistry I
Course Syllabus: Fall 2014

Instructor: Peter Balanda
ASC 3012, 591-5870, PeterBalanda@ferris.edu
Office Hours: M 11-12:50, W 1:00-2:50 and other by appointment
Lecture: MTWF 10:00-10:50 AM, SCI 102;

Laboratory Instructor: James Weaver
ASC 3014, 591-3610, Lab: JamesWeaver@ferris.edu
Office Hours: T 12:00-12:50, W 12:00-1:50, R 12:00-12:50
Lab: Sec 222, R 3:00-5:50; Sec 223, R 8:00-10:50; Sec 224, W 3:00-5:50; Sec 225, M 3:00-5:50. Science 336/328

University Catalog: Modern bonding theory in organic molecules, theory of reactions, stereochemical principles, chemistry of alkanes, cycloalkanes, alkenes, dienes, alkynes, aromatics, and alcohols, with special emphasis on reaction mechanisms. Concurrent laboratory includes basic laboratory techniques, synthesis, TLC and GC, stereochemistry and spectroscopy workshops. Pre-Requisites: CHEM 122 with a grade of C- or better.

Learning Outcomes for Organic Chemistry I

1. Demonstrate an understanding of the functionality and nomenclature of organic compounds by identifying functional groups in chemical structures, systematically naming molecules given their structures, and drawing structures given their names.
2. Predict relative physical and spectral properties of organic compounds based on chemical structures.
3. Predict chemical reactivity of organic compounds based on their chemical structure—functionality, size, shape, regio-, and stereochemistry—emphasis on the chemistry of hydrocarbons and haloalkanes.
4. Demonstrate a basic understanding of the energetic and mechanistic pathways of organic reactions by drawing reaction energy profile diagrams and illustrating reaction mechanisms.
5. Develop the techniques necessary to plan and execute the synthesis, purification, and characterization of organic compounds.

Required Textbooks:
- ✓ McMurry, J. ***Organic Chemistry***, 8th Ed. A hard cover version of the text is not required, and an earlier edition will be suitable for most purposes. An e-book version is included with the required Online Web-based Learning (OWL) system required for this course (next item).
- ✓ OWLv2 with QuickPrep 24-Months Printed Access Card for McMurry's Organic Chemistry, 8th. Link to our OWLv2 course shell: http://login.cengagebrain.com/course/E-TWQN2R7CG8HJ6

Required Materials:
- ✓ Laboratory notebook *(required 1st day of lab)*: Hayden McNeil type, spiral bound, 50-100 page with carbonless paper; ***top page perforated***
- ✓ **Molecular Model Set for Organic Chemistry** by Prentice Hall (Molymod)
- ✓ Instructor approved safety goggles (sold in the bookstore)
- ✓ Solvent resistant gloves (Chemical stripping gloves, nitrile gloves)

- ✓ An inexpensive scientific calculator

Recommended Materials:

- ✓ Molecular drawing software [free versions of ChemSketch, (http://www.acdlabs.com/download/); you'll need this for your presentations.
- ✓ McMurry, S. ***Study Guide and Solutions Manual for McMurry's Organic Chemistry***

Attendance: Attendance and class participation are mandatory components of both the laboratory and lecture portions of this course, and can expect to regularly respond to questions, both orally and in writing. High stakes quizzes or activities will be announced in advance; low stakes (5pts or less) will be given at any time, both to gauge attendance, and to encourage attentiveness and preparation. Students will be required to work individually and to work in groups. Missed laboratory assignments may not be made up. Excused absences (verifiable and in writing: extenuating medical reason, funeral, subpoena to testify, or university excused absence) may allow for the waving of an assignment, but do not lower the expectations for learning. If a test, quiz or activity is missed (excused absences only), it must be made up before the next class meeting by arrangement with the instructor (exceptions will be made only when extenuating circumstances prevent timely return). A missed test, not made up prior to the next class period will be replaced by the final exam. If no tests are missed, the lowest test score (if lower than the final exam score) will be replaced by the final exam. Three unexcused absences or five absences of any kind, in the laboratory portion of the course will result in failure of the course. Failure to take the final exam will result in failure of the course.

Homework: Regularly log into FerrisConnect and OWLv2 for updates on assignments, due dates, etc. ***Carefully read the assigned pages, and review the assigned PowerPoint lectures prior to class.*** Complete all web-based (OWL) assignments on time. Complete, with understanding, all *Problems* in the chapter, as well as many *Additional Problems* as time will allow. Unless specifically stated, these problems will be not be graded. However, the *Problems* found within the body of the text will provide guidelines for a large number of test questions, and similar problems will be presented in regular quizzes. You'll need to spend an ***absolute minimum*** of 12 hours per week reviewing lecture notes, reading the text, solving problems in the text and OWL, and otherwise preparing for upcoming lectures, quizzes and tests to expect more than a C in this course. That's just the nature of the material. Practice, practice, practice. ***She who the most problems wins!***

Electronics: Cell phones will be turned off during scheduled class periods. Portable computing devices may be used for note taking purposes, and for displaying and clarifying course content. Use of such devices for any other purpose is prohibited. ***Audio and/or video recording is prohibited***. The classroom environment is to be a safe place, where students and faculty can ask questions and express their views without fear of those conversations appearing on the internet. In addition, some of the lecture materials are copyrighted property of content publishers, who have given faculty limited rights for their use in a closed course setting. All materials are the intellectual property of the faculty author and may not be posted or reposted on the internet in any form.

Grading:

Lecture (80% of Grade)

Quizzes/Activities (1-20 pts each; < 100 pts)
Presentation (25 pts)
Tests (4 x 100 pts each)
Cumulative Final Exam (200 pts)
OWL Homework (100 pts)

Grade	Percent	Grade	Percent
A	93.0	C	73.0
A-	90.0	C-	70.0
B+	87.0	D+	67.0
B	83.0	D	63.0
B-	80.0	D-	58.0
C+	77.0	F	<58.0

Laboratory (20 %)
Experiments (13-14 x 10 pts)
Preparedness, Professionalism & Performance (1 point/lab day)
Students repeating the course may opt to be excluded from lab if they previously scored 80% in lab portion of the course. To do so, have your prior instructor e-mail the lab score to balandap@ferris.edu. Likewise, send an e-mail to the same address stating that you wish to be excluded from the lab, and that you understand that your new course grade will be based solely on the work you do this term (lecture percent determines course grade).

Laboratory:

- Prior to each laboratory session, students will review the materials presented on the course schedule, and download, review and print the appropriate laboratory experiment. You should come to class ready to work. Ideally, pre-lab discussions should merely review key points and safety concerns.
- Students will work with a permanent partner. Both partners will record their procedures and observations for every experiment. The original copy of each laboratory page will be submitted at the end of every class period. One of the two sets of lab notebook pages will be graded (typically 10 points per day). Both students will receive the same score.

Laboratory Notebook:

- Never tear out a page (except as directed for grading).
- Write your name, your partner's name, the date and your lab day on every page. You may use initials of second and third pages submitted each session.
- Write in black or dark blue permanent ink.
- The lab notebook must have a table of contents, and have every page numbered (both sides, in the upper right corner).
- New experiments begin on a new page, with a descriptive title and, in some cases, a purpose statement. If the experiment involves a chemical reaction, then the reaction equation must appear beneath the title at the top of the title page (with amounts needed, molecular weights, densities [if taken by volume], etc. under the structures).
- When continuing a prior experiment after beginning a new one, write "continued on page ..." at the bottom of the old page, and "continued from page..." at the top on the new page.
- Blank space at the bottom of a page should be crossed out with a diagonal line. Errors should be corrected by drawing a single line through the mistake; the erroneous statement or data should still be legible.
- A detailed account of the methods and observations must be recorded *as the experimental work is performed* (complete sentences, past tense).

This is a description of what was done, and what was observed, and is written in the past tense. Associate observations with actions.

- To avoid lost data and transcription errors, all data and calculations are recorded directly in the laboratory notebook (so, bring your lab notebooks to the balance, refractometer, etc.).
- Compounds, solutions, etc. should be labeled by the first initials of the observer, page number of the lab notebook, and the order of the appearance on the page. Example: John Smith describes a blue solution (JS23A) while writing on page 23 in his notebook, then notices a blue solid (JS23B) precipitating from JS23A. The code created for a sample is recorded on sample labels, copies of IR spectra, and on subsequent pages of the notebook, should that sample be used in further work.
- Results should be summarized in a short conclusion. Typically, it is possible to summarize an experiment with a single declarative sentence, followed by one of two supporting statements. For example, if the purpose was to synthesize a particular compound, the conclusion might look something like "4-Bromophenol was synthesized from phenol by bromination with Br_2 in acetic acid in 56% yield. Mp 62-67°C [lit. 64-68°C (Aldrich)]."

The instructor reserves the right to modify this syllabus to meet the changing needs of the class.

CHEM 321 Fall 2014 Schedule

Peter Balanda ASC 3012 591-5870 PeterBalanda@ferris.edu
James Weaver ASC 3012 591-3610 JamesWeaver@ferris.edu

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00				Lab Sec 223	
9:00				SCI 336/328	
10:00	SCI 102 Balanda	SCI 102 Balanda	SCI 102 Balanda	Weaver	SCI 102 Balanda
11:00	Office Hours	Meetings		Meetings	
12:00	Balanda	Office Hr - Weaver	Office Hr - Weaver	Office Hr - Weaver	
1:00			Office Hours		
2:00			Balanda		
3:00	Lab Sec 225		Lab Sec 224	Lab Sec 222	
4:00	SCI 336/328		SCI 336/328	SCI 336/328	
5:00	Weaver		Weaver	Weaver	
6:00					

Professor Balanda's Fall 2014 Schedule *ASC 3012 591-5870* *balandap@ferris.edu*

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00					
9:00					
10:00	CHEM 321, SCI 102	CHEM 321, SCI 102	CHEM 321, SCI 102		CHEM 321 SCI 102
11:00	Office Hours	Meetings		Meetings	
12:00					
1:00		CHEM 211, SCI 120	Office Hours	CHEM 211, SCI 120	
2:00		(1:30-2:45)		(1:30-2:45)	
3:00		CHEM 211	CHEM 211		
4:00		Lab Sec 211	Lab Sec 212		
5:00		SCI 117/332	SCI 308/332		
6:00					

Chemistry 321: Fundamentals of Organic/Polymer Chemistry
Fall 2014: Tentative Course Schedule

Date	McMurry Readings	McMurry PowerPoint		Kahn Academy Videos		Topic/ Special Events		Lab	Lab Items
M 8/25						Welcome, syllabus		Lab safety; Check in; Determination of Melting Point Review: Melting Point Determination; Read: Writing the Laboratory Notebook, and the information in the syllabus	Model Kit
T 8/26	1.1-1.5	Show	PDF	Dot structures; Bond-line structures		Valence shell electrons; Lewis structures			
W 8/27	1.6-1.12			Hybridization; Hybrid orbitals		VSEPR, hybridization, MO theory & drawing molecules			
F 8/29	2.1-2.6	Show	PDF	Electronegativity; Formal charge and resonance		Electronegativity, bond polarity, dipole moments, formal charge & resonance			
M 9/1						Labor Day/ No lecture		No lab [*or*, Intro. to Chemical Reactivity]	
T 9/2						Quiz: Drawing Resonance Structures			
W 9/3	2.7-2.10					Bronsted-Lowry acids & bases			
R 9/4	2.11-2.12			Acid/base		Lewis acids & bases, noncovalent interactions			
M 9/8	3.1	Show	PDF	Functional groups		Functional groups & Hydrocarbons		Boiling Point, Refractive Index, Distillation, and GC (1); Review: Vapor Pressure Curves - Algebra Lab; Read: Background Information	Model Kit
T 9/9	3.2-3.5			Naming alkanes;		Alkanes: structure, nomenclature & properties			
W 9/10	3.6-3.7			Conformations		Alkane conformation			
F 9/12	4.1-4.5	Show	PDF	Naming alkanes, cycloalkanes, and bicyclic compounds		Cycloalkanes: stability & conformation; naming & cis/trans isomerism			
M 9/15	4.6-4.9			Conformations of alkanes and cycloalkanes		Conformational stability of substituted cycloalkanes & polycyclic molecules		Boiling Point, Refractive Index, Distillation, and GC (2): Determine fraction purities by R.I. and G.C.; Review: Distillation I: Simple & Fractional Distillations	
T 9/16	5.1-5.5	Show	PDF	Chirality and the R,S system; Chirality and absolute configuration; Optical activity		Enantiomers, chirality, optical activity, sequence rules			
W 9/17	5.6-12			Diastereomers and meso compounds		Diastereomers, meso compounds, racemic mixtures, prochirality, other atoms, nature			
F 9/19						Catch up/Review/Activity			
M 9/22						**Test 1 (Ch. 1-5)**		Boiling Point, Refractive Index, Distillation, and GC (3); Review: Introduction to GC.; Dehydration of Alcohols: Preliminary Studies	Model Kit
T 9/23	6.1-6.11	Show	PDF			Reactions: classification, mechanisms & intermediates			
W 9/24						Describing energy changes, equilibria and reaction rate			

F 9/26	7.1-7.5	Show	PDF	Naming alkenes; Alkene nomenclature		Alkenes: degree of unsaturation, isomerism & nomenclature		
M 9/29	7.6-7.9			Alkene reactions (1)		Stability of alkenes, electrophilic addition & carbocation stability	Dehydration of Alcohols: Dehydration of 4-Methylpentan-2-ol	Calculator
T 9/30	7.10-7.11					Hammond Postulate & carbocation rearrangement		
W 10/1	8.1-8.3, 8.12-8.13	Show	PDF			Preparation of alkenes & addition reactions of alkenes		
F 10/3	8.4-8.6			Alkene reactions (2)		Oxymercuration, hydroboration, carbenes, hydrogenation		
M 10/6	8.7-8.9					Oxidations: epoxidation, hydroxylation & cleavage	Finish Dehydration of Alcohols lab from previous week; Thin Layer Chromatography of Analgesics; Review: TLC: The Basics	Model Kit Calculator
T 10/7						Quiz: Mechanisms of Alkene Reactions		
W 10/8	8.10					Vinyl polymerization; Radical additions to alkenes		
F 10/10	9.1-9.4	Show	PDF	Naming and preparing alkynes		Alkynes: naming, preparation, addition of HX, X2, H_2O		
M 10/13	9.5-9.9			Alkyne reactions		Alkynes: reduction, oxidative cleavage & alkylation	Recrystallization (1): Recrystallization of sodium salycylate; Solubility tests; Review: Recrystallization	
T 10/14				Synthesis using alkynes		Introduction to Multistep Synthesis/Activity		
W 10/15	10.1-10.2			Free radical reactions; Naming alkyl halides		Alkyl halides: naming, structure, preparation		
F 10/17	10.3-10.4					Allylic bromination		
M 10/20	10.5-10.8	Show	PDF	Preparation of alkyl halides from alcohols; Oxidation and reduction		RX: prep from ROH, Grignard, Gilman; redox in organic chemistry	Recrystallization (2): Purification of unknown	
T 10/21						Catch up/Review/Activity		
W 10/22						Test 2 (Ch. 6-10)		
F 10/24	11.1-11.3			Nucleophilicity and basicity; SN1 vs SN2; SN1 and SN2;		SN2 reactions		
M 10/27	11.4-11.6					SN1 reactions, biological substitution rxns	Acid/base extraction (1): Exploration of solubility behavior & development of a separation scheme	
T 10/28	11.7-11.9			Elimination reactions; E1 and E2 reactions		E2, deuterium isotope effect, E2 with cyclohexane		
W 10/29	11.10-11.12			Sn1/Sn2/E1/E2 (Sal); Sn1/Sn2/E1/E1 (Jay)		E1, E1cb, Biological elimination, summary of reactions		
F 10/31	14.1-14.3, 14.6	Show	PDF	Addition reactions of conjugated dienes; Molecular orbital theory		Conjugated dienes: stability, MO theory, addn to & K vs k control, diene polymers		
M 11/3	14.4-14.5			Diels-Alder reaction		Diels-Alder reaction	Acid/base extraction (2): Separation of an unknown mixture	
T 11/4						Quiz: Substitution/Elimination Mechanisms		
W 11/5		Show	PDF	Naming benzene derivatives; Aromatic stability		Aromatic compounds and ions, Hückel rule		
F 11/7						Aromatic heterocycles, Frost's circle, polycyclics, spectroscopy (intro)		

M 11/10						Test 3 (Ch. 11, 14.1-14.,15)		Steam distillation of cloves (1), Obtaining an Infrared Spectrum	
T 11/11	12.5, 14.7-14.9					Conjugated polymers, dyes and UV-Vis Spectroscopy			
W 11/12	12.1-12.4	Show	PDF			Mass spec			
F 11/14	12.6-12.8					IR spectroscopy			
M 11/17	13.1-13.3	Show	PDF			NMR		Steam distillation of cloves (2) & Polymerization of Styrene and MMA	
T 11/18	13.4-13.7					^{13}C NMR & ^{13}C DEPT			
W 11/19	13.8-13.13					^{1}H-NMR			
F 11/21						^{1}H NMR (practice problems)			
M 11/24	Instructions					Student Presentations		No Lab	
T 11/25						Student Presentations			
W 11/26						Student Presentations			
F 11/28						No Class			
M 12/1						Integration of spectroscopy, Spectral Problem 1 key		IR of Polymer Film; Check out and clean-up	
T 12/2						Test 4 (Ch. 12,13,14.7-14.9,15.7)			
W 12/3						Final Review			
F 12/4						Final Review			
T 12/9						Final Exam: 10:00-11:40 AM			

Chemistry 322: Organic Chemistry 2
Course Syllabus: Summer 2014

Instructor: Peter Balanda, Ph.D., Professor of Chemistry
ASC 3012, 591-5870, balandap@ferris.edu
Office Hours: MTWR 10:05-10:50, and other by appointment.
Lecture (SCI 336): MTWR 8:00-10:05
Lab (SCI 336/328): MWR 11:00-1:50

University Catalog: Students should be able to demonstrate an understanding of the structure, nomenclature, physical properties, and chemical properties of the major classes of organic compounds: Arenes and aromatic heterocycles; alcohols and phenols; ethers and epoxides; thiols and sulfides; aldehydes and ketones; carboxylic acids and their derivatives. Students should be able to demonstrate similar familiarity with common classes of biomolecules: carbohydrates, proteins, lipids and nucleic acids. In the concurrent laboratory sessions, students will demonstrate the ability to plan and carry out experiments designed to gain a better understanding of organic structure/property relationships, with special emphasis on experimental design; isolation spectroscopic analysis of products; and evaluation and presentation of results.

Learning Outcomes for Organic Chemistry 2

1) Demonstrate an understanding of the functionality and nomenclature of organic compounds by identifying functional groups in chemical structures, systematically naming molecules given their structures, and drawing structures given their names.
2) Predict relative physical and spectral properties of organic compounds based on chemical structures.
3) Predict chemical reactivity of organic compounds based on their chemical structure (functionality, size, shape, regio-, and stereochemistry)—emphasis on arenes and compounds containing oxygen, nitrogen and sulfur.
4) Design multistep syntheses of organic compounds.
5) Demonstrate a more developed understanding of the energetic and mechanistic pathways of organic reactions by drawing reaction energy profile diagrams and illustrating reaction mechanisms.
6) Plan and execute the synthesis, purification, and characterization of organic compounds.
7) Learn to communicate effectively using the vocabulary of organic chemistry both orally and in written form.

Required Textbooks: ✓ McMurry, J. ***Organic Chemistry***, 8th Ed. with ***OWLv2. Register for OWL here***

Course Enrollment
Begin by going to http://login.cengagebrain.com.

Don't Already Have an Account?

1. Click "Create an Account."
2. In the "Enter Code or Course Key" box, submit the course key: **E-TWQN48E988AD5**.
3. Provide the "Account Information" when asked.
4. You will land on the "My Home" page at cengagebrain.com, and you will see an Open button. Click that button.

Already Have an Account?

1. Provide your credentials and click the "Log In" button.
2. In the "Have Another Product to Register?" field, submit your course key: **E-TWQN48E988AD5**.
3. You will see a new book appear, with an Open button. Click that button.

Payment

After registering, you can buy access on myhome.cengagebrain.com (your least expensive option) or purchase an access code from your bookstore.

Required Materials:

- ✓ Laboratory notebook: Hayden McNeil type, spiral bound, 50-100 page with carbonless paper; ***top page perforated***
- ✓ Instructor approved safety goggles (sold in the bookstore)
- ✓ Solvent resistant gloves (Chemical stripping gloves, nitrile gloves)
- ✓ Scientific calculator
- ✓ ChemSketch Molecular drawing software [free version available from http://www.acdlabs.com/download/

Recommended Materials:

- ✓ **Molecular Model Set for Organic Chemistry** by Prentice Hall (Molymod)
- ✓ McMurry, S. ***Study Guide and Solutions Manual for McMurry's Organic Chemistry***

Attendance: Attendance and class participation are mandatory components of both the laboratory and lecture portions of this course, and can expect to regularly respond to questions, both orally and in writing. High stakes quizzes or activities will be announced in advance; low stakes (5ps or less) will be given at any time, both to gauge attendance, and to encourage attentiveness and preparation. Students will be required to work individually and to work in groups. Missed laboratory assignments may not be made up. Excused absences (verifiable and in writing: extenuating medical reason, funeral, subpoena to testify, or university excused absence) may allow for the waving of an assignment, but do not lower the expectations for learning. If a test, quiz or activity is missed (excused absences only), it must be made up before the next class meeting by arrangement with the instructor (exceptions will be made only when extenuating circumstances prevent timely return). A missed test, not made up prior to the next class period will be replaced by the final exam. If no tests are missed, the lowest test score (if lower than the final exam score) will be replaced by the final exam. Three unexcused absences or five absences of any kind, in the laboratory portion of the course will result in failure of the course. Failure to take the final exam will result in failure of the course.

Homework: Carefully read the assigned pages prior to class. Regularly log into FerrisConnect for updates on assignments, due dates, etc. Complete all web-based (OWL) assignments on time. Complete, with understanding, all *Problems* in the chapter, as well as many *Additional Problems* as time will allow. Unless specifically stated, these problems will be not be graded. However, the *Problems* found within the body of the text will provide guidelines for a large number of test questions, and similar problems will be presented in regular quizzes. You'll need to spend a minimum of 12 hours per week reviewing lecture

notes, reading the text, solving problems in the text and OWL, and otherwise preparing for upcoming lectures, quizzes and tests.

Electronics: Cell phones will be turned off during scheduled class periods. Portable computing devices may be used for note taking purposes, and for displaying and clarifying course content. Use of such devices for any other purpose is prohibited. ***Audio and/or video recording is prohibited***. The classroom environment is to be a safe place, where students and faculty can ask questions and express their views without fear of those conversations appearing on the internet. In addition, some of the lecture materials are copyrighted property of content publishers, who have given faculty limited rights for their use in a closed course setting. All materials are the intellectual property of the faculty author and may not be posted or reposted on the internet in any form.

Laboratory: Laboratory assignments must be completed and turned in on time in order to guarantee that credit is received. Missed laboratory assignments may not be made up. Laboratory grades will be based on instructor-, peer- and self-evaluation. Students will work in groups. Groups will carry out two research projects. Students will be expected to participate in the design of the second project. Each student will maintain a laboratory notebook, and submit laboratory results (original copy from carbonless lab notebook) at the end of every laboratory period. Results will be presented to the class using PowerPoint. A final, evening, poster presentation will be scheduled during the last week of class. Each group will assemble and maintain a well organized Research Project Portfolio (use a three ring binder) which includes copies of experimental plans and laboratory notebook entries (instructor reviewed), as well as all instrument request sheets, spectral data and data analysis forms. In addition, students will be expected to make revisions to experimental plans and presentations at the instructor's request.

Students repeating the course may opt to be excluded from lab if they previously scored 80% in lab portion of the course. To do so, have your prior instructor e-mail the lab score to balandap@ferris.edu. Likewise, send an e-mail to the same address stating that you wish to be excluded from the lab, and that you understand that your new course grade will be based solely on the work you do this term (lecture percent determines course grade).

Laboratory Notebook:

- ***A detailed account of the methods and observations must be recorded as the experimental work is performed (complete sentences, past tense). This is a description of what was done, and what was observed, and is written in the past tense. Associate observations with actions.***
- Never tear out a page (except as directed for grading).
- Write your name, your partner's name, the date and your lab day on every page. You may use initials of second and third pages submitted each session.
- Write in black or dark blue permanent ink.
- The lab notebook must have a table of contents, and have every page numbered (both sides, in the upper right corner).
- New experiments begin on a new page, with a descriptive title and, in some cases, a purpose statement. If the experiment involves a chemical reaction, then the reaction equation must appear beneath the title at the top of the title page (with amounts needed, molecular weights, densities [if taken by volume], etc. under the structures).

- When continuing a prior experiment after beginning a new one, write "continued on page ..." at the bottom of the old page, and "continued from page..." at the top on the new page.
- Blank space at the bottom of a page should be crossed out with a diagonal line. Errors should be corrected by drawing a single line through the mistake; the erroneous statement or data should still be legible.
- To avoid lost data and transcription errors, all data and calculations are recorded directly in the laboratory notebook (so, bring your lab notebooks to the balance, refractometer, etc.).
- Compounds, solutions, etc. should be labeled by the first initials of the observer, page number of the lab notebook, and the order of the appearance on the page. Example: John Smith describes a blue solution (JS23A) while writing on page 23 in his notebook, then notices a blue solid (JS23B) precipitating from JS23A. The code created for a sample is recorded on sample labels, copies of IR spectra, and on subsequent pages of the notebook, should that sample be used in further work.
- Results should be summarized in a short conclusion. Typically, it is possible to summarize an experiment with a single declarative sentence, followed by one of two supporting statements. For example, if the purpose was to synthesize a particular compound, the conclusion might look something like "4-Bromophenol was synthesized from phenol by bromination with Br_2 in acetic acid in 56% yield. Mp 62-67°C [lit. 64-68°C (Aldrich)]."

Grading: Lecture (80% of course grade)

Quizzes/Activities (1-20 pts each; ≤ 100 pts)
Tests 1-4 (100 pts each)*
Test 5 (25-50 pts)
Cumulative Final Exam (150 pts)
OWL Homework (100 pts)

Grade	Percent	Grade	Percent
A	93.0	C	73.0
A-	90.0	C-	70.0
B+	87.0	D+	67.0
B	83.0	D	63.0
B-	80.0	D-	58.0
C+	77.0	F	<58.0

*A missed test, not made up prior to the next class period will be replaced by the final exam. If no tests are missed, the lowest test score (if lower than the final exam score) wil be replaced by the final exam.

Laboratory (20% of course grade)

NMR & IR of Starting Compounds (15)

Project 1 (60)

Portfolio (15)

Experimental Plan (4)	*Signed and dated by instructor*
Instrument Request Sheets (2)	*Signed and dated by instructor*
Experimental Data (3)	*Originals and working copies*
Data Interpretation Sheets (3)	*Signed and dated by instructor*
Lab Notes (2)	*Copies of all notebook entries*
Organization (1)	

Presentation: (35):
Presentation Critiques (5)
Asked relevant questions (1)
Individual performance evaluation (4)

Project 2 (125)

Portfolio (40)

Experimental Plan (4)	*Signed and dated by instructor*
Instrument Request Sheets (6)	*Signed and dated by instructor*
Experimental Data (6)	*Originals and working copies*
Data Interpretation Sheets (6)	*Signed and dated by instructor*
Lab notes (10)	*Copies of all notebook entries*
Organization (3)	
~~*Poster (5)*~~	

Presentation: (75)
Presentation Critiques (5)
Asked relevant questions (1)
Individual performance evaluation (4)

Course Schedule

Day	Date	McMurry readings	Materials	Videos	Topic/ Special Events	Lab	Due
W	7/2				Introduction	Introduction; Check in	
R	7/3	16.0-16.3 16.4-16 .6	Ch16 (PP, PDF)	KA	Electrophilic arom. sub. EAS subtituent effects	NMR Demo.; NMR and IR: Analysis of Starting Materials or Unknowns	-Project Assignment -Review MIT Videos on Refluxing a Reaction and TLC
M	7/7	16.7-end			Nucleophilic aromatic substitution; benzyne; side-chain rxns; reductions; synthesis of trisubstituted benzenes *Synthesis: aromatic compounds,* ***Q1***	Project 1 Assignment; Development of experimental plan (due end of period)	-NMR Report/Data Interpretation Sheet -Review MIT Videos on Refluxing a Reaction and TLC
T	7/8	17.0-17.2 17.3-17.5	Ch17 (PP, PDF)	KA	ROH & ArOH: naming; physical & acid/base properties Preparation of alcohols		
W	7/9	17.6-17.8			Reactions of alcohols *Synthesis: alcohols,* ***Q2***	Project 1 *(1)*	
R	7/10	17.9-end			Phenols & spectroscopy NMR review, ***Q3***	*(2)*	-Review MIT Videos on Reaction Work-up and Filtration
M	7/14				***Test 1 Ch. 16-17***	*(3)*	
T	7/15	18.0-18.2 18.3-18.4	Ch 18 (PP, PDF)	KA	Ethers: naming & preparation Ethers: reactions		
W	7/16	18.5-end			Epoxides, crown ethers; thiols; sulfides; spectroscopy *Synthesis: ethers,* ***Q4***		Electronic copy of PowerPoint by midnight
R	7/17	Preview of Carbonyl Chemistry 19.0-19.3 19.4-19.7	Ch 19 (PP, PDF)	KA	Carbonyl preview Aldehydes & ketones: naming; preparation; oxidation Nucleophilic addn: H_2O, HCN, RMgX	Team presentations and class critique	-power point presentation -presentation critiques -research portfolio -group evaluations
M	7/21	19.8-19.10 19.11-19.13			Nuc. addn: amine, hydrazine, alcohol Wittig; Cannizzaro; conjugate addition	Project 2 Assignment; Development of experimental plan (due end of period)	-Review MIT Videos on Recrystallization and Column Chromatography

T	7/22	19.14-end			R(CO)R & RCHO: Spectroscopy *Synthesis: aldehydes & ketones,* ***Q5***		
W	723				***Test 2 Ch. 18-19***	Project 2 *(1)*	
R	7/24	20.0-20.4 20.5-20.6	Ch 20 (PP, PDF)	KA	RCOOH: naming; phys. prop.; acidity RCOOH: Preparation; Intro. to Rxns		
M	7/28	20.7-end			Chemistry of nitriles; RCOOH: spectroscopy *Synthesis: RCOOH,* ***Q6***	*(2)*	
T	7/29	21.0-21.3 21.4 21.5-21.7	Ch 21 (PP, PDF)		R(CO)X: naming; nucleophilic acyl substitution (S_NAc) R(CO)X: S_NAc, cont. (acid halides) R(CO)X: S_NAc, cont. (anhydrides, esters, & amides),		
W	7/30	21.8-end			R(CO)X: Biol. derivatives; polymers, Spectroscopy of R(CO)X *Synthesis: RCOOH derivatives,* ***Q7***	*(3)*	
R	7/31				***Test 3 Ch. 20-21***	*(4)*	
M	8/4	22.0-22.4 22.5-22.6	Ch 22 (PP, PDF)	KA	Carbonyl α-substitution: Enols Carbonyl α-substitution: Enolates	*(5)*	
T	8/5	22.7-end			Alkylation of enolates *Synthesis: enolate chemistry,* ***Q8***		
W	8/6	23.0-23.6 23.7-23.9	Ch 23 (PP, PDF)		Carbonyl condensation rxns: aldols Claisen condensations	*(6)*	
R	8/7	23.10-end			Michael, Stork, Robinson & biol. con. *Synthesis: carbonyl condensation,* ***Q9***	Wrap up lab work; cleanup and checkout	Electronic copy of PowerPoint due by midnight
M	8/11	24.0-24.5 24.6	Ch 24 (PP, PDF)	KA	Amines: naming; phys. Prop., basicity Amines: preparation	Team presentations and critique	-power point presentation -presentation critiques -research portfolio -group evaluations
T	8/12	24.7-24.8 24.9-end			Amines: reactions Heterocycles & amine spectroscopy *Synthesis: amines,* ***Q10***		
W	8/13				***Test 4 Ch 22-24***	**ACS Cumulative Final Exam**	

To ensure that the needs of individual students are met the instructor reserves the right to make any necessary changes.

Biochemistry Laboratory 1 CHEM 332 Fall '12

Dr. Kim K. Colvert Office Hours: MRF 9:00-9:50 T 1:00-1:50 ASC 3098
R 12:00 pm - 12:50 pm Starr 233 Lecture
F 1:00 pm - 4:50pm Science 337 Lab

Laboratory theory and techniques of biochemistry are introduced. Experiments focus on the application of photometry, chromatography, electrophoresis and activity assays to the isolation and analysis of biomolecules such as amino acids, proteins, enzymes and nucleic acids. Requires: CHEM 322

Textbook: Boyer, "Modern Experimental Biochemistry", Addison-Wesley, Supplemental materials will be provided.

Supplies: Gridded notebook with perforated carbon sheets, approved safety goggles, metric straight edge, calculator (suggest a scientific).

Learning Outcomes: The successful student will

- use basic biochemical techniques and equipment
- work neatly and efficiently in lab with respect for others
- use a lab notebook to keep accurate and useful records of laboratory activities
- prepare clear and concise reports of activities that
    - explain the theories of techniques and concepts encountered
    - describe the experimental process
    - use theories to explain experimental results, account for deviations, summarize and propose alternate or future experimentation

Grading: Grades will be based on as many lab reports as we complete, written as described in the following pages. We will focus on developing effective communication techniques in two phases. In Phase I all of your work will be done in your lab notebook. You will use the practices described in the following pages to record laboratory activities and analyses. Records of each day's work are worth 50 pts./day and the copies are due at the end of each day. Results and analysis are worth 50 pts./day and the copies are due the week after completion of the exercise. These sections will be graded primarily for completeness and presentation as well as content. In other words you could lose points for failure to label properly, leaving out data, not showing important calculations, leaving off units and so on. Remember, keeping the notebook is a real time exercise. No extra time is provided at the end to "catch up". In Phase II the focus will be on creating a "journal article format" report worth 100 pts/day in lab. There will be a final exam during the last laboratory period and clean up will take place during the scheduled final exam time.

Cheating : In a word, don't. See ***Student Handbook***. Penalty for a first offense will be a zero for that assignment. A second offense will result in failure of the course. The

introduction to your report will be closely scrutinized for plagiarism. Use your own words and organization.

Absences/Make up Labs: There will be no make-up labs. Absence from lecture will not be counted against you but will be to your disadvantage. Absence from a lab which requires more than one lab period will result in a proportionate deduction. For example, if a lab requires 2 lab periods and you miss one you may obtain the data from your partner but 20% will automatically be deducted from the completed report. If you miss a lab that only requires one period an excused absence might be negotiated if the reasons are fully documented. Missing three labs for any reason will result in failure of the course. **Late assignments WILL NOT BE ACCEPTED!!!!**

Tentative Lab Schedule

Aug 30/31 Introduction Lecture, Lab Tour, Safety, Library Assignment

Sept. 6/7 Buffers

-----13/14 Spectrophotometry
-----20/21 Centrifugation

-----27/28, Oct. 4/6, 11/12 Chromatography

,-----18/19, 25/26 Electrophoresis

Nov.1/2, Nov. 8/9, 15/16 Enzyme kinetics
------24/25 Thanksgiving
------29/30 Computer Lab
Dec. 6/7 Final Exam
Lab Clean-Up during Finals Week

LAB NOTEBOOKS AND REPORTS

In a lab notebook you will record all the information necessary to write a report. It is a running account of everything done in an experiment—the procedure (suggested and what you actually did) errors, accidents, the conditions of the experiment, the data collected, the calculations, notes to yourself, lecture notes, literature references, errors and so on. It should include a table of contents and therefore each experiment should be titled and the pages numbered. It is like a diary in many ways. You ought to be able to go back to your notebook, even years later, and know exactly what you did and why you did it. Theoretically, if you were to die, a fellow scientist could reconstruct your research from your notebooks. From the data and analysis in a notebook you should be able to write a "journal paper" or for our purposes a report.

It is helpful to prepare notebook tables in advance for any data you need to collect so it is labeled and ready to fill in as you take your measurements. This will not always be practical and you must learn to keep the notebook as you work recording observations, data and ideas as you go through a procedure. Whatever you do don't take your data down on the odd piece of paper thinking you will enter it in your notebook later. Neatness is important; you must be able to tell exactly what each piece of data is. Labels are critical. If you get sloppy you might not know what information to use where in your write- up.

When it is not appropriate to use computer-generated graphs they should be done on standard graph paper with 20 squares to the inch. They must conform to the following format:

a. *margins free of any writing*
b. *a suitable and descriptive title*
c. *x-axis (independent variable) label and units*
d. *y-axis (dependent variable) label and units*
e. *both axes conveniently and correctly scaled*
f. *data points plotted clearly and precisely (consider circles, squares, etc. around point to be sure they are separated from lines and don't forget a legend if necessary)*
g. *smooth curves or straight lines drawn when appropriate.*
h. *one idea per graph (may be more than one line, however)*
i. *neat and pleasing appearance*

Note: Even computer generated graphs must follow the format!

Biochemistry Laboratory CHEM 333

Biochemistry laboratory techniques and theory are continued. Experiments will include the isolation of sub-cellular systems such as chloroplasts, mitochondria and microsomes. The metabolic properties of these systems, including chemiosmotic coupling, electron transport and substrate preference will be examined. This course meets General Education requirements: Scientific Understanding, Lab.

Requires: *CHEM 332* ***and*** *CHEM 364*

Instructor: Dr. Kim K. Colvert **Office:** ASC 3098

Hours: MWF 11-11:50 T 1-1:50 (or by appt.)

Textbook: Supplemental material will be provided.

Learning Outcomes: The successful student will

- apply basic biochemical techniques and equipment to more complex systems
- work neatly and efficiently in lab with respect for others
- use a lab notebook to keep accurate and useful records of laboratory activities
- use theories to explain experimental observations in appropriate scientific language and format

Supplies: Gridded notebook with perforated carbon sheets, goggles, metric straight edge, graph paper (no larger than 10 divisions/in.), scientific calculator.

Grading: Grades will be based on Notebook work and lab reports as described below.

Absences/Make up Labs: There will be no make-up labs. Absence from lecture will not be counted against you but will be to your disadvantage. If you miss connect up with a classmate! Absence from a lab which requires more than one lab period will result in a proportionate deduction. For example, if a lab requires 2 lab periods and you miss one you may obtain the data from your partner but you will lose any notebook value and 40% of the report. If the absence can be verified as an excused absence (Dean's definition) you are still responsible for the report but will not be held accountable for the notebook work and can receive full value. If you have an excused absence for a lab that only requires one period your final grade will be adjusted for the missing report. Missing three labs for any reason will result in failure of the course.

The Notebook

There must be a Table of Contents at the beginning. Start each lab day with a date and title. List in the table of contents. Begin with a statement of the day's OBJECTIVE (not whole lab if multiple). This is very important and should be based on your understanding of the task for the day (remember the lecture!). It will help you in writing your introduction in the report.

Ex. In order to determine the melting temperature of calf thymus DNA changes in viscosity and absorbance at 260 nm with respect to temperature will be investigated. Results will be interpreted in light of viscosity and hyperchromic effect theories and compared to literature values.

It is also a good idea to identify HAZARDS.

Then proceed to record **all activities**. The PROCEDURE can use well-labeled tables when appropriate, record solution concentrations. Include drawings of specialized equipment. Make sure everything is clear by using titles. Do necessary CALCULATIONS neatly. Record all DATA. If data is instrument- generated label well and make a copy to be pasted into the notebook and one for the report. **Be detailed and thorough**. If a subsequent experiment uses an identical procedure the first may be referenced by notebook page number. If the procedure differs then it must be clearly explained how it differs. Remember, errors must be lined through, not scribbled out. If your handwriting is bad, improve it. At some point in the semester I will ask you to submit some portion of your notebook. Your ENTIRE notebook grade will be based on this "pop" submission.

The Lab Report

Title the report. In the INTRODUCTION start with a context for the total experiment, essentially a re-working of all of the objective statements. This is where you demonstrate your understanding of THE BIG PICTURE. Be sure it is clear in this section what the lab(s) was/were designed to demonstrate. This requires that you identify the theories and concepts. You must choose how detailed this is. Avoid explaining the simplistic but be sure that any theory you intend to use to explain your results in the discussion section is at least generally acknowledged...save exact details for the discussion section. Set the stage for your results.

PROCEDURE: Third person, passive, past tense is required. Tables are encouraged if properly labeled. If your notebook was done well this should be easy to convert to the proper style.

RAW DATA: Within the body of the report identify in a list all the data you will include in an Appendix (properly labeled)

CALCULATIONS: Within the body of the report identify in a list all the calculations you will include in another Appendix (properly labeled and showing formula and one example)

Present and describe the RESULTS. Each result must be reported whether in graph or table or not. Sometimes all you do is report a value as the result of a process and there is nothing else to say. Sometimes you will have to identify a trend in a graph or table. Save the explanation for the
DISCUSSION: here it is all about elaborating on the theory that allows your interpretation. Tables and Figures presented in the RESULTS must be properly identified when explaining what the information means. This is how you prove you understood the experiment so be thorough. Each individual piece of information contributes to a total picture so make the connections clearly.

CONCLUSION: There should be a final paragraph summing up the experiment—focus on the theory and less on how easy or difficult it was to perform.

References **must** be incorporated into the report and tied to the BIBLIOGRAPHY at the end.
APPENDICES: These always include Raw Data and Calculations but there may be others (extensive protocols, images, etc.)

Each report will be worth 100 points for the first day + 30 points for each additional day. (Ex. if a report covers three lab periods it will be worth 160 pts). The random notebook check will be worth 100 pts.

Potential Labs (not necessarily in order)
Sweet Potato Enzymology
Photosynthetic Pigments
Photosynthesis Assays
Mitochondrial Electron Transport
Recombinant protein isolation (?)

CHEM 364 - Biochemistry

Spring 2015-MTRF 8-8:50 – Str 233

Instructor: *Dr. Konara (Yamuna) Kollalpitiya, Assistant Professor of Chemistry*
Office: *ASC 3088* **Email:** KonaraKollalpitiya@ferris.edu **Telephone:** (231) 591-2597
Office Hours: M *9:00-11:00, W 2:00- 2:50, R 2:00-2:50, and other times by appointment.*

Course Description (Four Credit Hours):

University Catalog: A rigorous course in the chemistry of such biomolecules as amino acids, polypeptides, proteins and enzymes, carbohydrates, lipids and nucleic acids. The structure/function relationships of these biomolecules will be stressed and the biosynthetic and biodegradative pathways discussed. Credit will not be given for both CHEM 324 and CHEM 364. This course meets General Education requirements: Scientific Understanding.
Pre-Requisites: CHEM 322 with a grade of C- or better.

Student Learning Outcome:

Upon completion of this course, a successful student will be able to:

- apply chemistry concepts and skills acquired in previous courses to living systems to reveal the molecular nature of life.
- master new concepts, facts and skills to support analysis and interpretation of biochemical processes.
- relate chemical structures of biomolecules to biological function.
- develop a sufficient background to study more advanced biochemistry topics.

Required material:

Text book: You can use any biochemistry text book published within last five years including the text book previously used in this class "Principles of Biochemistry," Horton, 5th edition, Prentiss Hall.

Sapling Learning: You will need to purchase access to the homework for this class through Sapling Learning. It is available from bookstore or on line.

A scientific calculator- You will need a calculator for tests. It cannot be a graphing or programmable calculator.

Blackboard:

I highly recommend you to check the blackboard constantly. I post lecture powerpoint slides, study guides, other assignments, homework due dates, and announcements on blackboard.

Attendance:

Attendance at class and examinations is required. Attendance will be noted daily. There is no penalty for being absence. However, you will lose points for in class assignment or group activity. An absence will only be excused with a written reliable note: Severe illness or hospitalization (note from a doctor), jury duty (copy of your court summons), interview (copy of email or letter you have received). Students are responsible for making up missed class assignments. If you plan to attend athletic contest or school sponsored event, notify me two weeks in advance. The University also has a policy and a form for students' absences due to University-sponsored functions. Students must present a copy of the form to instructor prior to leaving.

Homework:

I will assign homework problems from most of the chapters. Each assignment is worth 10 points.

Exams and Grades:

I will post a study guide on blackboard for each exam. Your grade will be based on your performance in several areas. The relative contributions are:

Exams (3x100)	300
Cumulative final exam	100
Homework	100
Assignment/ worksheet/group work/quiz	200

Your grade will be determined as a percentage of the total number of possible points.

A	93.0%	B+	87.0%	C+	77.0%	D^+	67.0%
A-	90.0%	B	83.0%	C	73.0 %	D	63.0%
		B-	80.0%	C-	70.0%	D-	58.0%

Special Needs:

Ferris State University is committed to following requirements of the Americans with Disabilities Act Amendments Act and Section 504 of the Rehabilitation Act. If you are a student with disability or think you may have a disability, please contact the disabilities Services office at 231.591.3057 or send an e-mail message to ecds@ferris.edu to discuss your request further. More information can be found online at: Http://www.ferris.edu/htmls/colleges/university/disability.

University and College Standards, Procedures, and Policies:

I will not tolerate any kind of academic misconduct in the classroom, and I will follow university standards and procedures in such situations. These policies are designed to support your success in this course and your career.

Code of Student Community Standards, including **Disciplinary Procedures:**

http://www.ferris.edu/htmls/administration/StudentAffairs/Studenthandbook/
Academic Misconduct, including **Cheating, Fabrication, Facilitating Academic Dishonesty, Interference, Plagiarism, Violation of Course Rules**, and **Violation of Professional Standards and Ethics** (from the **Code of Student Community Standards** (see, specifically, http://www.ferris.edu/HTMLS/administration/studentaffairs/studenthandbook/general/homepage.htm)
Student Dignity and Harassment Policy (from the **Code of Student Community Standards**) see, specifically,
http://www.ferris.edu/HTMLS/administration/studentaffairs/studenthandbook/administrative/homepage.htm)

Student Support Services:
Here are some of the many services available to you.

Ferris State has Academic Support Center and Tutoring:
http://www.ferris.edu/HTMLS/colleges/university/ASC/
The Writing Center: http://www.ferris.edu/HTMLS/statewide/resources/writing.htm
"Strategies for YOUR Educational Success" workshops; a link to the Fall 2013 Workshop Schedule is at: http://www.ferris.edu/HTMLS/colleges/university/eccc/strategies.htm
Personal Counseling Center:
http://www.ferris.edu/HTMLS/studentlife/PersonalCounseling/index.htm
Educational and Career Counseling:
http://www.ferris.edu/HTMLS/colleges/university/eccc/assessment.htm
Librarians at FSU Library for Information Technology and Education (FLITE; see http://www.ferris.edu/library/)

Tentative Schedule:

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	1/12 Intro	1/13 Intro	1/14	1/15 Water	1/16 Water
2	1/19 MLK Day	1/20 Water	1/21	1/22 A.A.	1/23 Protein
3	1/26 Protein	1/27 Protein	1/28	1/29 Protein	1/30 Protein
4	2/02 Protein	2/03 Enzyme	2/04	2/05 Exam I	2/06 Enzyme
5	2/9 Enzyme	2/10 Enzyme	2/11	2/12 Enzyme	2/13 Sugar
6	2/16 Sugar	2/17 Sugar	2/18	2/19 Sugar	2/20 Lipid
7	2/23 Lipid	2/24 Membrane	2/25	2/26 Membrane	2/27 Membrane
8	3/02 Energy	3/03 Energy	3/04	3/05 Exam II	3/06 Glycolysis
Spring Break	3/9	3/10	3/11	3/12	3/13
9	3/16 Glycolysis	3/17 Glycolysis	3/18	3/19 Gluconeogen.	3/20 P-P Pathway
10	3/23 Gly. Metab.	3/24 Ch 9	3/25	3/26 TCA cycle	3/27 TCA cycle
11	3/30 ETC	3/31 ETC	4/01	4/02 No classes	4/03 No classes
12	4/06 ETC	4/07 ETC	4/08	4/9 Lipid Met.	4/10 Lipid Met.
13	4/13 Lipid Met.	4/14 N. Met	4/15	4/16 N. Met	4/17 N. Met
14	4/20 N. Met	4/21 Exam III	4/22	4/23 Nu. Acid	4/24 Nu. Acid
15	4/27 Nu. Acid	4/28 Nu. Acid	4/29	4/30 Nu. Acid	5/01 Review
16	5/04	5/05	5/06	5/07 Final ExamSTR 233 8-9:40	5/08

CHEM 381 COURSE SYLLABUS: Spring 2014

CHEM 381 Section 001

Inorganic Chemistry (3 Credits)

Instructor: C. Partigianoni

Note: The instructor reserves the right to make needed and appropriate adjustments in the syllabus

I. General Course Information

Instructor: C. Partigianoni Office: ASC 3095 Phone: 591 – 5038

Email: partigic@ferris.edu

Office Hours: Mon, Tues, Thur, Fri: 12:30 — 1:30 PM

AND BY APPOINTMENT

If the designated office hours are not convenient for you, please feel welcome to make an appointment for any time that the instructor is available.

Lecture: M–W–F: 11:00 – 11:50 AM SCI 336

II. Course Description, Prerequisites and Outcomes

Course Description: An overview course covering the fundamental principles and theories of inorganic chemistry, with emphasis on the chemistry of d-block elements. Included topics are molecular structure, electronic structure and spectra, bonding descriptions and reaction mechanisms of coordination complexes along with an introduction to organometallic compounds of d-block elements and an introduction to molecular symmetry and point groups. Course recommended for students intending to pursue graduate study in chemistry.

Course Prerequisites: CHEM 122 and CHEM 321

Course Outcomes: In this course students will be expected to :

1. construct molecular orbital diagrams for inorganic complexes and correlate these diagrams with electronic absorption spectra

2. describe bonding and stabilization energies in coordination complexes using molecular orbital theory and crystal field theory

3. identify molecular symmetry point groups of compounds

4. apply group theory to bonding and vibrational spectroscopy of inorganic complexes

5. rationalize and apply the 18-electron rule to transition metal coordination complexes

6. identify common reaction mechanisms of coordination complexes and explain which factors affect the rates of these reactions

7. identify and explain trends in the descriptive chemistry of main group elements

8. carry out calculations involving unit cell dimensions

III. Required Textbooks and Materials:

1) General Chemistry Textbook
2) Partigianoni's CHEM 381 Course Packet and 3-ring notebook

IV. Course Requirements:

1) Activities: Activities provided in the course packet will be assigned as homework. You will be graded based on whether or not the activities are completed for homework

2) Exams: Exams will be administered on the dates provided below. Overall grades for the course will be assigned based on homework and exam grades

Exam Dates:

Exam I: Thur: 2/6 (7:00 pm): 100 points

Exam II: Thur: 3/ 6 (7:00 pm): 100 points

Exam III: Thur: 4/ 10 (7:00 pm): 100 points

Exam IV: Thur: 5/1 (7:00 pm): 75 points

Final Exam: Thur 5/8 (10:00 – 11:40 am) 100 points

V. Grading: Overall grades for the course will be assigned based on homework and exam grades using the grading scale below. The instructor reserves the right to make minor adjustments (in the students' favor) based on natural demarcations in the grades.

Homework: 40 points

Exams: 475 points:

GRADING SCALE:

	A:	93.0 % or above	A–	90.0 – 92.9 %
B+: 87.0 – 89.9 %	B:	83.0 – 86.9 %	B–	80.0 – 82.9 %
C+ 77.0 – 79.9 %	C:	73.0 – 76.9%	C–	70.0 – 71.9%
	D:	60.0 — 69.9%		
	F:	Below 60 %		

VI. Policies:

Attendance Policy:

Excused Absences: All excused absences, as defined below, must be confirmed with appropriate documentation;

1) illness (with appropriate documentation from health officials)
2) death in immediate family
3) approved university-related travel

Attendance is mandatory. You may miss up to 3 lectures without penalty REGARDLESS OF CAUSE. Each additional absence, **REGARDLESS OF CAUSE**, will result in a 3 % deduction from your final grade, (which can mean the difference between an A and an A–). The instructor MAY make an exception to the grade penalty if **all** absences are due to a prolonged illness which lasts more than 1 week.

Make-Up Policy

Anyone who has an excused absence from an exam will be given the opportunity to make-up the exam. **It is the student's responsibility to contact the instructor BEFORE the regularly scheduled exam date and receive prior approval for a make-up exam.**

VII. Course Outline:

I. Molecular Orbital Theory (MOT)

A. An overview of MOT
B. MOT Applied to homonuclear diatomics
C. MOT Applied to heteronuclear diatomics
D. Ligand group orbitals
E. MOT applied to polyatomic molecules

II. Molecular Symmetry

A. Review of VSPER and molecular shapes
B. Symmetry operations and elements
C. Point Groups
D. Character tables: a brief introduction
E. Application of Group Theory in infrared spectroscopy and bonding

III. Structures and Energetics of Metallic and Ionic Solids

A. Common shapes of unit cells and packing arrangements in crystalline solids

B. Calculations involving unit cell dimensions

C. Band Theory of Metals, insulators and semiconductors

D. Lattice Energy, Born-Haber Cycle

IV. Acid–Base

A. Lewis acid-based theory

B. Hard / Soft acids and bases

V. Coordination Complexes

A. Stability constants and factors affecting stability

B. Isomerism

C. Crystal Field Theory

D. MOT

E. Ligand field theory

F. Electronic Spectra

G. Magnetic Properties

VI. Common Reaction Mechanisms of Coordination Compounds

A. Ligand Substitution Reactions

B. Electron Transfer (inner sphere and outer sphere)

C. Rate Equations, mechanisms

D. trans-effect

VII. Introduction to Organometallic Compounds

A. Common types of ligands and bonding

B. The 18-electron rule

C. Metal Carbonyls

D. Reaction Mechanisms

E. Catalysis

VIII. Chemistry of the Main Group Elements

A. Alkali and alkaline earth metals

B. Group VA elements

C. Group VIA

D. Halogens

CHEM 474 Advanced Biochemistry

10:00 am - 10:50 am MWF Science Building 111

Builds on the introduction to biochemistry presented in CHEM 364. Metabolism will be examined in greater detail, stressing mechanisms, regulation, and research implications. A significant component of the course is literature driven, requiring research, analysis, and discussion of current topics in biochemistry. This course meets General Education requirements: Scientific Understanding.
Requires:
CHEM 231 **or** CHEM 451; **&** CHEM 364 **&** BIOL 375

Dr. Kim K.Colvert
ASC 3098 ex. 5851

Office Hours: MTF 9-9:50 W 11-11:50
or by appointment

Text: "Biochemistry", Voet and Voet, 4th edition, Wiley

Learning Outcomes:

Survey courses in biochemistry lay a general framework of information and analytical skills. By building on this foundation this course will help students pursuing careers relating to biochemistry become more sophisticated in the evaluation and analysis of biochemical relationships. To this end the course will focus on advanced concepts in metabolism and will contain a significant literature review component. Students will:

1) Deepen specific understanding of anabolism and catabolism stressing regulation and interdependency of pathways.
2) Develop the ability to analyze and predict metabolic effects.
3) Increase awareness of biochemical literature.
4) Develop skills in the evaluation of published research.
5) Enhance skills in oral and written communication of scientific information.

Grading:

Grades in this course will be based on three exams, two literature presentations, participation in discussion and a research paper. The exams will be take home exams. Each exam is worth 1/6 of your grade. There will also be presentations of literature required from each student. A paper must be selected for presentation. The paper should be a single-topic, peer reviewed article (not a review paper) must be provided to the class and a copy provided to the instructor no later than the Monday before presentation. The presentation will consist of a brief explanation of the point of the research, the techniques and the results. Critical evaluation is expected, discussion will take place. The whole class must participate. There will be two of these per student in this semester. Each presentation is worth 1/8 of your grade and your participation is also worth 1/8. The research paper must be at least ten single-spaced, Times-New Roman-12, equivalent pages long, and reference at least ten sources. No more than two of these sources may be internet sources. Topics must be submitted and approved by January 29. Papers are due April 20. The paper is worth 1/4 of your grade. There will be a compulsory final.

Cheating and Plagiarism

Don't. You are **absolutely** on the honor system. First offense, zero for that assignment. Second offense, failure of the course. If I suspect your work is not your own, especially on the exams I will not hesitate to implement the penalties. **Don't make it necessary**.

Probable Lecture/Discussion Topics

Review of Metabolism
- Review of catabolism and links to catabolic paths

Biosynthesis of amino acids
- The five families and histidine
- Amino acid analogs

Metabolic fate of amino acids
- Synthesis of porphyrin, glutathione
- Neurotransmitters

Nucleotide metabolism
- Anabolism, catabolism, regulation
- Biosynthesis of nucleotide coenzymes

Biosynthesis of complex carbohydrates
- Monosaccharides to polysaccharides
- Bacterial cell walls
- Glycoproteins, receptor mechanisms

Photosynthesis
- Light reactions--photosystems and chlorophyll
- Dark reactions--CO_2 to sugars

Lipid metabolism
- Fatty acids
- *phospholipid synthesis
- *Membrane assembly
- * Protein targeting
- Cholesterol metabolism
  - Cholesterol, lipoproteins, bile acids steroid hormones, vitamin D

Special Topics

Exams (Tentative)
1--Post amino acids
2--Post complex carbohydrates
3--Post Special Topics
Comprehensive Final Tuesday, May 6 8:00 am

CHEM 451 – Intro to Physical Chemistry **Spring 2015**

Instructor	Office	Phone	E-mail
Dr. Mark Thomson	ASC 3007	(231) 591-5895	MarkThomson@ferris.edu
Office Hours	MTRF	1:00-1:45	
	W	9:00-10:00	
	and by appointment		

Lecture	Tuesday	8:00 – 9:15	SCI 336		
	Wednesday	8:00 – 8:50	SCI 336		
	Thursday	8:00 – 9:15	SCI 336		

Course Description: An overview course covering some of the fundamental topics, including the gas state, the first and second laws of thermodynamics, free energy, physical and chemical equilibrium, electrochemistry, chemical kinetics, reaction mechanisms, and the solid state. Pre-Requisites: CHEM 322, PHYS 212 or PHYS 242, and MATH 220.

Course Outcomes: Upon completion of this course, a student will:

1. Identify the role and limitations of using models in ideal and real systems to describe chemical behavior.
2. Solve chemical problems in thermodynamics and kinetics including:
    a. Differentiation of heat, work, energy, enthalpy, etc.
    b. Amounts of heat, work, and energy change for various processes.
    c. Reaction and state change calculations and phase diagrams.
    d. Integrated rate laws and rate laws calculations.
3. Explain the application of theory to chemical systems including the Kinetic Molecular Theory of Matter and the application of Collision Theory and Transition State Theory in describing chemical kinetics.
4. Identify sources for past investigations on specific chemical topics in the literature, locate these sources, and summarize the work done in both oral and written reports.

Materials Required:

Physical Chemistry for the Chemical and Biological Sciences, Chang, University Science Books, ISBN 978-1-891389-06-1.

Non-programmable Scientific Calculator – You will be expected to have a scientific calculator and to know how to use it (ask before the exam if you do not know how). Make sure your calculator is in good working order before each exam. Calculators will NOT be shared during an exam for any reason.

Course Evaluation:

Homework Assignments/Quizzes: There will be regular homework assignments posted in class and on FerrisConnect. Each assignment will have a clear due date and it will be the student's responsibility to make sure that they complete the assignment before the deadline. No late work will be accepted. Homework assignments will be totaled at the end of the semester and scaled to a total possible value of 100 points.

Special Project – Literature Review: There will be an oral/written project worth 200 points. The due date and the nature of the project will be discussed in class. Further details, will be posted on FerrisConnect before midterms.

Exams: There will be three exams worth 100 points each. The dates are tentatively listed as February 10, March 19, and April 21.

Final Exam: The Final Exam will be worth 200 points. The final exam will be **comprehensive**, including topics from previous exams as well as new material covered after Exam #3. It is scheduled for Thursday, May 7, 2015 at 8:00.

The Final Grade will be determined as follows, based on a total of 800 possible points.

A = average between 90% and 100%.
B = average between 80% and 89%.
C = average between 70% and 79%.
D = average between 60% and 69%.
F = average below 60%.

Course Requirements and Policies:

Behavior Policy: Free discussion, inquiry, and expression are encouraged in this class. Classroom behavior that interferes with either (a) the instructor's ability to conduct the class or (b) the ability of students to benefit from the instruction is not acceptable. Examples may include routinely entering class late or departing early; use of beepers, cellular telephones, or other electronic devices; repeatedly talking in class without being recognized; talking while others are speaking; or arguing in a way that is perceived as "crossing the civility line." In the event of a situation where a student legitimately needs to carry a beeper/cellular telephone to class, prior notice and approval of the instructor is expected.

Attendance Policy: Attendance is expected. In this course, a student will be considered absent if they miss more than half the scheduled class period. It is understood that emergencies might come up suddenly. If possible, let the instructor know beforehand that you will be missing class.

If you are not present in class, it will be assumed that something else was more important than this class at that time. As an adult, these are decisions with consequences that you need to make and take responsibility for. It will be impossible and unreasonable for your instructor and classmates to recreate the experience of class for you. It will be your personal responsibility to find another way to obtain the missed knowledge and information and you will still be expected to use and apply this knowledge and information in future classes and on assignments and exams.

Students are allowed to miss up to 8 classes without penalty for any reason, excused or unexcused. Be careful and try to avoid problems at the end of the semester. Each additional absence will result in a 5% reduction in your final overall grade. The instructor reserves the right to make allowances in the event of extreme cases involving extended hospitalization or severe calamity.

E-mail and On-Line Communication Policy: I will do my best to check my e-mail account regularly and often. During the week (Monday-Friday), you should be able to expect a reply within 12-18 hours. On weekends, please recognize that I may be less connected to my accounts and a response may take 24-48 hours. You should be in the habit of checking FerrisConnect frequently. I will post general announcements and assignments there and you will be responsible for knowing about these things.

Inclement Weather Policy: The University remains open for classes unless officially decided otherwise. Decisions regarding campus closure are posted on the University web page. If necessary, announcements will also be posted on-line regarding work missed and rescheduled assignments or exams. Use your own best judgment if traveling from an off-campus site and let me know as soon as possible if weather conditions prevent you from attending class.

Students with Special Needs: I wish to provide all students in this course with the best opportunity to learn the material. Any student who feels they may need an accommodation based on the impact of a disability should contact me to discuss their specific needs. Any reasonable and appropriate accommodations should be discussed prior to the first exam. Please also contact the Disabilities Services Office, STR 313, (231)591-3057 to coordinate reasonable accommodations for documented disabilities.

The instructor reserves the right to modify this syllabus if necessary during the course of the semester. Any such changes will be discussed in class and posted in writing on FerrisConnect.

Appendix III
TracDat--Chemistry

Assessment: Program Four Column

Assessment: Chemistry BA

Program - Chemistry (B.A.)

Mission Statement: The mission of the Chemistry BA program is to provide students with the chemical knowledge and laboratory skills as well as the critical thinking, communication, and teamwork skills necessary to be successful in a chemical or science-related career.
Next FSU Academic Program Review: 2009-2010
College: CAS

Outcome	*Assessment Methods*	*Result*	*Actions*
Working Knowledge - Students should demonstrate a working knowledge of inorganic, organic, analytical and physical chemistry. **Outcome Type:** Learning	**Test - External - Post or Pre/Post -** Students will take a version of the ACS (American Chemical Society) one-year organic chemistry standardized examination at the end of CHEM 322. **Criterion for Success:** The mean score of FSU students taking this exam will be at or above the 50th percentile. **Assessment Schedule:** Every spring semester	**Action:** 2 - Pending Action **Classification:** Criterion Not Met At the end of CHEM 322 in Spring 2014 students took a standardized final exam in organic chemistry prepared by the American Chemical Society. The average score was 45.9% correct, which corresponds to the 30th percentile in terms of national norms. (08/28/2015) **Action:** 1 - No Action Required **Classification:** Criterion Met At the end of CHEM 322 in Summer 2014 students took a standardized final exam in organic chemistry prepared by the American Chemical Society. The average score was 60.8% correct, which corresponds to the 60th percentile in terms of national norms. (08/28/2015) **Action:** 2 - Pending Action **Classification:** Criterion Not Met At the end of CHEM 322 in Spring 2015 students took a standardized final exam in organic chemistry prepared by the American Chemical Society. The average score was 47.5% correct, which corresponds to the 34th percentile in terms of national norms. (08/28/2015) **Action:** 1 - No Action Required **Classification:** Criterion Met A total of 62 students took the ACS one-year organic chemistry standardized examination at the end of CHEM	

Outcome	Assessment Methods	Result	Actions
		322 in Spring 2011. The average score was 62.7% correct, which represents the 64th percentile in terms of national norms. (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met A total of 55 students took the ACS one-year organic chemistry standardized examination at the end of CHEM 322 in Spring 2012. The average score was 63 % correct, which represents the 64th percentile in terms of national norms. (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met A total of 21 students took the ACS one-year organic chemistry standardized examination at the end of CHEM 322 in Summer 2011. The average score was 57.8% correct, which represents the 54th percentile in terms of national norms. (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met 62 CHEM 322 students took the 2008 version of the Full Year ACS Organic Chemistry Exam with a mean of 43.87 out of a possible 70 points, placing the mean at the 64th percentile nationally. (05/03/2011)	
	Test - External - Post or Pre/Post - Students will take a version of the ACS (American Chemical Society) physical chemistry standardized examination at the end of CHEM 451. **Criterion for Success:** The mean score of FSU students taking this exam will be at or above the 40th percentile. **Assessment Schedule:** Every spring semester.	**Action:** 1 - No Action Required **Classification:** Criterion Met 20 CHEM 451 students took the 1999 version of the ACS Thermodynamics Exam with an average of 18 out of a possible 40 points, placing the average at the 65th percentile nationally. (05/08/2009)	
	Test - External - Post or Pre/Post - CHEM 451 students will take an examination at the beginning of the course demonstrating their knowledge in inorganic chemistry.		

Outcome	Assessment Methods	Result	Actions
	Criterion for Success: The mean exam score will be above 80%. **Assessment Schedule:** Every spring semester		
	Test - External - Post or Pre/Post - Students will take a version of the ACS (American Chemical Society) second semester general chemistry standardized exam. **Criterion for Success:** Students will score at least as high as the 50th percentile nationwide (i.e. Ferris students will score at or above the national average.) **Assessment Schedule:** every Spring Semester	**Action:** 1 - No Action Required **Classification:** Criterion Met A total of 153 students took the ACS (American Chemical Society) second semester general chemistry standardized exam at the end of Spring 2014 semester. The average score was 58% correct, which corresponds to the 59th percentile in terms of national norms. (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met A total of 152 students took the ACS (American Chemical Society) second semester general chemistry standardized exam at the end of Spring 2015 semester. The average score was 62.4 % correct, which corresponds to the 67th percentile in terms of national norms. (08/20/2015)	
Apply Understanding - Students should apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills. **Outcome Type:** Learning	**Test - Internally Developed - Pre/Post or Post -** CHEM 321 and/or CHEM 322 students will answer selected examination questions designated as requiring the application cognitive skill level (Bloom?s taxonomy). **Criterion for Success:** The mean score of students answering ?application? exam questions will be above 70%. **Assessment Schedule:** Annually, either in the fall semester or spring semester	**Action:** 2 - Pending Action **Classification:** Criterion Not Met Students took the American Chemical Society organic chemistry standardized final at the end of Spring 2011. A total of 20 questions were selected that require application cognitive skill level of Bloom's technology. The average score on these 20 selected questions was 66%. (08/26/2015)	
		Action: 2 - Pending Action **Classification:** Criterion Not Met Students took the American Chemical Society organic chemistry standardized final at the end of Spring 2012. A total of 20 questions were selected that require application cognitive skill level of Bloom's technology. The average score on these 20 selected questions was 62%. (08/26/2015)	
		Action: 2 - Pending Action **Classification:** Criterion Not Met Students took the American Chemical Society organic chemistry standardized final at the end of Summer 2011. A total of 20 questions were selected that require application	

Outcome	Assessment Methods	Result	Actions
		cognitive skill level of Bloom's technology. The average score on these 20 selected questions was 55%. (08/26/2015)	
Critically Evaluate - Students should critically evaluate the work of others and cooperate to solve problems. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.) -** CHEM 322 students in selected sections will evaluate 6-10 oral research presentations using an 8 point rubric. **Criterion for Success:** Student scores will agree with instructor scores within a predetermined standard deviation. **Assessment Schedule:** Every spring semester		
Lab Skills - Students should work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data. **Outcome Type:** Learning	**Observations (e.g. Clinical or Field) -** Students, upon second exposure to a given laboratory technique, will perform the technique safely and effectively without instructor assistance. (Courses: CHEM 321,322?) **Criterion for Success:** Over 80% of students will successfully demonstrate the technique without assistance. **Assessment Schedule:** Annually		
Accurate Measurements - Students should perform accurate and precise quantitative measurements and perform statistical analyses on resultant data to assess reliability of results. **Outcome Type:** Learning	CHEM 231 students will carry out accurate and precise measurements and assess reliability. **Criterion for Success:** The mean score on related exercises among students receiving a C or higher in the course will be above 80%.		
Effective Communication - Students			

Outcome	Assessment Methods	Result	Actions
should effectively communicate and present technical information in a clear, concise, scientifically appropriate manner in a variety of formats. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.) -** CHEM 451 students will write papers on course relevant topics both individually and in groups.		
	Written Product (essay, research paper, journal, newsletter, etc.) - CHEM 121, 122, 231, and 321 students will write formal lab reports following a specified report format. **Criterion for Success:** In designated lab sections the mean grade on a second or later lab report assignment will be above 80%. **Assessment Schedule:** Annually	**Action:** 1 - No Action Required **Classification:** Criterion Met In Fall 2010, the average score on a distillation lab report in CHEM 321 was 82%. (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Fall 2011, the average score on a distillation lab report in CHEM 321 was 92% (08/20/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Fall 2012, the average score on a distillation lab report in CHEM 321 was 89% (08/20/2015)	
		Action: 2 - Pending Action **Classification:** Criterion Not Met In Fall 2013, the average score on a distillation lab report in CHEM 321 was 77% (08/20/2015)	
	Presentation(Oral) - Students in selected sections of CHEM 322 will give two oral research presentations graded by an 8 point rubric. **Criterion for Success:** Mean score in the 8 areas on the second presentation will be 4 out of 5. **Assessment Schedule:** Every spring semester		

Appendix IV
TracDat--Biochemistry

Assessment: Program Four Column

Assessment for Biochemistry BA

Program - Biochemistry (B.A.)

Mission Statement: The mission of the Biochemistry BA program is to provide students with the biochemistry knowledge and laboratory skills as well as the critical thinking, communication, and teamwork skills necessary to be successful in a biochemical or science-related career.
Next FSU Academic Program Review: 2009-2010
College: CAS

Outcome	*Assessment Methods*	*Result*	*Actions*
Working Knowledge - Students should demonstrate a working knowledge of inorganic, organic, and physical chemistry. **Outcome Type:** Learning	**Test - External - Post or Pre/Post -** Students will take a version of the ACS (American Chemical Society) one-year organic chemistry standardized examination at the end of CHEM 322. **Criterion for Success:** The mean score of FSU students taking this exam will be at or above the 50th percentile. **Assessment Schedule:** Every spring semester	**Action:** 2 - Pending Action **Classification:** Criterion Not Met At the end of CHEM 322 in Spring 2014, students took a one-year standardized organic chemistry exam prepared by the ACS (American Chemical Society.). The average score was 45.9% correct, which corresponds to the 30th percentile in terms of national norms. (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met At the end of CHEM 322 in Summer 2014, students took a one-year standardized organic chemistry exam prepared by the ACS (American Chemical Society.). The average score was 60.8% correct, which corresponds to the 60th percentile in terms of national norms. (08/28/2015)	
		Action: 2 - Pending Action **Classification:** Criterion Not Met At the end of CHEM 322 in Spring 2015, students took a one-year standardized organic chemistry exam prepared by the ACS (American Chemical Society.). The average score was 47.5% correct, which corresponds to the 34th percentile in terms of national norms. (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met At the end of CHEM 322 in Spring 2011, 62 students took a one-year standardized organic chemistry exam prepared by	

Outcome	Assessment Methods	Result	Actions
		the ACS (American Chemical Society.). The average score was 62.7% correct, which corresponds to the 64th percentile in terms of national norms. (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met At the end of CHEM 322 in Spring 2012, 55 students took a one-year standardized organic chemistry exam prepared by the ACS (American Chemical Society.). The average score was 63% correct, which corresponds to the 64th percentile in terms of national norms. (08/28/2015)	
	Written Product (essay, research paper, journal, newsletter, etc.) - Representative lab reports of majors in CHEM 333 will be evaluated using a rubric. **Criterion for Success:** Over 75% of the majors will have satisfactory or better reports. **Assessment Schedule:** Every spring semester	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2013, the procedure section of a late-semester laboratory exercise was scored according to a rubric. The average score was 80.7 % (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2014, the procedure section of a late-semester laboratory exercise was scored according to a rubric. The average score was 85.3 % (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2013, the discussion section of a late-semester laboratory exercise was scored according to a rubric. The average score was 77.2 % (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2014, the discussion section of a late-semester laboratory exercise was scored according to a rubric. The average score was 73.5 % (08/28/2015)	
	Test - External - Post or Pre/Post - Students will take a version of the ACS (American Chemical Society) second semester general chemistry standardized exam. **Criterion for Success:** Students will score at least as high as the 50th percentile nationwide, (i.e. Ferris students will score at or above the national average.)	**Action:** 1 - No Action Required **Classification:** Criterion Met A total of 153 students took the ACS (American Chemical Society) second semester general chemistry standardized exam at the end of the Spring 2014 semester. The average score as 58% correct, which corresponds to the 59th percentile in terms of national norms. (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met A total of 152 students took the ACS (American Chemical	

Outcome	Assessment Methods	Result	Actions
	Assessment Schedule: annually	Society) second semester general chemistry standardized exam at the end of the Spring 2015 semester. The average score as 62.4 % correct, which corresponds to the 67th percentile in terms of national norms. (08/28/2015)	
Basic Knowledge - Students should demonstrate the basic knowledge of biology topics supporting their understanding of biochemistry. **Outcome Type:** Learning			
Relationship - Students should articulate the relationship between chemistry and the biological sciences. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.)** - A paper focused on current research in biochemistry will be assigned in CHEM 474. **Criterion for Success:** The class average will be 65% or above. **Assessment Schedule:** Every spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2014, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 90.0 % (08/28/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2015, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 80..0 % (08/28/2015)	
	Written Product (essay, research paper, journal, newsletter, etc.) - A singles research paper will be presented to the class and evaluated with a rubric in CHEM 474. **Criterion for Success:** The class average will be at or above 65% **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2014, the class average was 84.5% (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2015, the class average was 83.0% (08/31/2015)	
	Test - Internally Developed - Pre/Post or Post - The class average of all exams in CHEM 474 will be recorded. **Criterion for Success:** The class average for all exams will be 65% or above **Assessment Schedule:** Every Spring semester	**Action:** 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2014 was 79.78%. (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2015 was 76.6%. (08/31/2015)	

Outcome	Assessment Methods	Result	Actions
Apply Understanding - Students should be able to apply their understanding of chemistry and supporting disciplines to analyze and solve chemical problems utilizing formal and concrete thinking skills. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.)** - A paper focused on current research in biochemistry will be assigned in CHEM 474. **Criterion for Success:** The class average will be 65% or above. **Assessment Schedule:** Every spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2014, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 90.0 % (08/29/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2015, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 80.0 % (08/29/2015)	
	Written Product (essay, research paper, journal, newsletter, etc.) - A singles research paper will be presented to the class and evaluated with a rubric in CHEM 474. **Criterion for Success:** The class average will be at or above 64% **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2014, the class average was 84.5% (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2015, the class average was 83.0% (08/31/2015)	
	Test - Internally Developed - Pre/Post or Post - The class average of all exams in CHEM 474 will be recorded. **Criterion for Success:** The class average for all exams will be 65% or above **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2014 was 79.78%. (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2015 was 76.6%. (08/31/2015)	
Critically Evaluate - Students should know how to critically evaluate the work of others and cooperate to solve problems. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.)** - Part of the assessment rubric for the literature presentation (rubric to be developed) in CHEM 474. **Criterion for Success:** Over 75% of the students will meet the criterion score (to be determined) **Assessment Schedule:** Every sprin semester in CHEM 474		

Outcome	Assessment Methods	Result	Actions
Lab Skills - Students should demonstrate the skills to work in a chemistry laboratory in a safe and effective manner, applying the scientific method to the design, execution and interpretation of experiments and experimental data. **Outcome Type:** Learning			
Biochemical Lab - Students should demonstrate mastery of basic biochemical laboratory techniques and theories associated with analysis/manipulation of biomolecules. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.)** - Representative lab reports of majors in CHEM 333 will be evaluated using a rubric. **Criterion for Success:** Over 75% of the majors will have satisfactory or better reports. **Assessment Schedule:** Every spring semester	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2013, the procedure section of a late-semester laboratory exercise was scored according to a rubric. The average score was 80.7 % (08/29/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2014, the procedure section of a late-semester laboratory exercise was scored according to a rubric. The average score was 85.3 % (08/29/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2013, the discussion section of a late-semester laboratory exercise was scored according to a rubric. The average score was 77.2 % (08/29/2015)	
		Action: 2 - Pending Action **Classification:** Inconclusive In Spring 2014, the discussion section of a late-semester laboratory exercise was scored according to a rubric. The average score was 73.5% (08/29/2015)	
Effective Communication - Students should recognize the value of effective communication and be able to present technical information in a clear, concise, scientifically appropriate manner in a variety of formats. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.)** - A paper focused on current research in biochemistry will be assigned in CHEM 474. **Criterion for Success:** The class average will be 65% or above **Assessment Schedule:** Every spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2014, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 90.0 % (08/29/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2015, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 80.0 % (08/29/2015)	

Outcome	Assessment Methods	Result	Actions
	Written Product (essay, research paper, journal, newsletter, etc.) - A singles research paper will be presented to the class and evaluated with a rubric in CHEM 474. **Criterion for Success:** The class average will be 65% or above. **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2014, the class average was 84.5% (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2015, the class average was 83.0% (08/31/2015)	
	Test - Internally Developed - Pre/Post or Post - The class average of all exams in CHEM 474 will be recorded. **Criterion for Success:** The class average for all exams will be 65% or above **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2014 was 79.78%. (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2015 was 76.6%. (08/31/2015)	
Scientific Literature - Students should be able to retrieve and use peer-reviewed scientific literature and evaluate technical articles critically. **Outcome Type:** Learning	**Written Product (essay, research paper, journal, newsletter, etc.) -** A paper focused on current research in biochemistry will be assigned in CHEM 474. **Criterion for Success:** The class average will be 65% or above. **Assessment Schedule:** Every spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In Spring 2014, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 90.0 % (08/29/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In Spring 2015, a paper focused on current research in biochemistry was assigned in CHEM 474. The average score was 80.0 % (08/29/2015)	
	Written Product (essay, research paper, journal, newsletter, etc.) - A singles research paper will be presented to the class and evaluated with a rubric in CHEM 474. **Criterion for Success:** The class average will be 65% or above. **Assessment Schedule:** Every Spring	**Action:** 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2014, the class average was 84.5% (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met In CHEM 474, singles research papers were presented to the class and evaluated by a rubric. In Spring 2015, the class average was 83.0% (08/31/2015)	
	Test - Internally Developed -	**Action:** 1 - No Action Required	

Outcome	Assessment Methods	Result	Actions
	Pre/Post or Post - The class average of all exams in CHEM 474 will be recorded. **Criterion for Success:** The class average for all exams will be 65% or above **Assessment Schedule:** Every Spring	**Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2014 was 79.78%. (08/31/2015)	
		Action: 1 - No Action Required **Classification:** Criterion Met The average of all exam scores for CHEM 474 in Spring 2015 was 76.6%. (08/31/2015)	

Appendix V

Surveys

Exit
Alumni
Faculty
Current Students

15 Chem-Biochem APR Exit Frequencies

Prepared by: Institutional Research & Testing, 08/15

Statistics

	N		Mean	Median	Std. Deviation
	Valid	Missing			
q1_1 Take at FSU: CHEM 121 General Chemistry 1	1	1	1.00	1.00	
q1_2 Take at FSU: CHEM 122 General Chemistry 2	1	1	1.00	1.00	
q1_3 Take at FSU: CHEM 231 Quantitative Analysis	1	1	1.00	1.00	
q1_4 Take at FSU: CHEM 321 Organic Chemistry 1	2	0	1.00	1.00	.000
q1_5 Take at FSU: CHEM 322 Organic Chemistry 2	2	0	1.00	1.00	.000
q1_6 Take at FSU: CHEM 364 Biochemistry	1	1	1.00	1.00	
q2a Chemistry or Biochemistry courses	2	0	3.00	3.00	.000
q2b Courses in your minor	2	0	1.50	1.50	.707
q2c Courses that incorporated critical thinking/problem solving	2	0	3.00	3.00	.000
q2d Courses that incorporated computer experiences	2	0	2.50	2.50	.707
q2e Courses in quantitative skills/mathematics	2	0	2.50	2.50	.707
q2f Courses in written communication/writing	2	0	2.50	2.50	.707
q2g Courses in oral or interpersonal communication	2	0	3.00	3.00	.000
q2h Courses in foreign language	2	0	2.00	2.00	.000
q2i Courses in social awareness	2	0	2.50	2.50	.707
q2j Courses in cultural enrichment	2	0	2.00	2.00	.000
q3a Your experiences in laboratory courses	2	0	2.50	2.50	.707
q3b The laboratory facilities in Chem or Biochem	2	0	3.00	3.00	.000
q3c Your ability to work in a chemistry lab in a safe manner	2	0	3.50	3.50	.707
q3d The expertise of your Chemistry faculty in their professional areas	2	0	2.50	2.50	.707
q3e The availability of books/journals/information (both in the library & on-line)	2	0	2.50	2.50	.707
q3f The Chemistry or Biochemistry program overall	2	0	2.50	2.50	.707
q4a CHEM 121 General Chemistry 1	1	1	4.00	4.00	
q4b CHEM 122 General Chemistry 2	1	1	4.00	4.00	
q4c CHEM 321 Organic Chemistry 1	2	0	2.50	2.50	.707
q4d CHEM 322 Organic Chemistry 2	2	0	2.50	2.50	.707
q5 What 2-3 aspects of the Chem or Biochem prog most satisfied with	2	0			
q6 What 2-3 changes to the prog would have made it a better experience	2	0			
q7 Additional comments	2	0			
q8 Which degree are you seeking	2	0	1.50	1.50	.707
q9 Also obtain an Associates degree in Industrial Chem Tech (ICT)	2	0	1.50	1.50	.707
q10 Semesters attended college before attaining BA	2	0	1.50	1.50	.707
q11 Enter the Chem or Biochem prog	2	0	2.50	2.50	.707
q12 Prompted your interest in the Chem or Biochem prog	2	0	1.50	1.50	.707
q12a Other Specified	2	0			
q13 Immediate plans once you graduate	2	0	1.00	1.00	.000
q13a Other Specified	2	0			
q14 Staying in MI after graduation	2	0	2.00	2.00	1.414

Frequency Table

q1_1 Take at FSU: CHEM 121 General Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	50.0	100.0	100.0
Missing	Not Selected	1	50.0		
Total		2	100.0		

q1_2 Take at FSU: CHEM 122 General Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	50.0	100.0	100.0
Missing	Not Selected	1	50.0		
Total		2	100.0		

q1_3 Take at FSU: CHEM 231 Quantitative Analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	50.0	100.0	100.0
Missing	Not Selected	1	50.0		
Total		2	100.0		

q1_4 Take at FSU: CHEM 321 Organic Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	100.0	100.0	100.0

q1_5 Take at FSU: CHEM 322 Organic Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	2	100.0	100.0	100.0

q1_6 Take at FSU: CHEM 364 Biochemistry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	50.0	100.0	100.0
Missing	Not Selected	1	50.0		
Total		2	100.0		

q2a Chemistry or Biochemistry courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	2	100.0	100.0	100.0

q2b Courses in your minor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Dissatisfied	1	50.0	50.0	50.0
	Somewhat Dissatisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q2c Courses that incorporated critical thinking/problem solving

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	2	100.0	100.0	100.0

q2d Courses that incorporated computer experiences

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q2e Courses in quantitative skills/mathematics

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q2f Courses in written communication/writing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q2g Courses in oral or interpersonal communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	2	100.0	100.0	100.0

q2h Courses in foreign language

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	2	100.0	100.0	100.0

q2i Courses in social awareness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q2j Courses in cultural enrichment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	2	100.0	100.0	100.0

q3a Your experiences in laboratory courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q3b The laboratory facilities in Chem or Biochem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	2	100.0	100.0	100.0

q3c Your ability to work in a chemistry lab in a safe manner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	1	50.0	50.0	50.0
	Very Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q3d The expertise of your Chemistry faculty in their professional areas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q3e The availability of books/journals/information (both in the library & on-line)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q3f The Chemistry or Biochemistry program overall

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q4a CHEM 121 General Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	1	50.0	100.0	100.0
Missing	System	1	50.0		
Total		2	100.0		

q4b CHEM 122 General Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Satisfied	1	50.0	100.0	100.0
Missing	System	1	50.0		
Total		2	100.0		

q4c CHEM 321 Organic Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q4d CHEM 322 Organic Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Dissatisfied	1	50.0	50.0	50.0
	Somewhat Satisfied	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q5 What 2-3 aspects of the Chem or Biochem prog most satisfied with

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	50.0	50.0	50.0
	Safety procedures, lab experiences.	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q6 What 2-3 changes to the prog would have made it a better experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	50.0	50.0	50.0
	More in depth lab experience, better aid with career/job placement, degree being a BS.	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q7 Additional comments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	100.0	100.0	100.0

q8 Which degree are you seeking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Chemistry BA	1	50.0	50.0	50.0
	Biochemistry BA	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q9 Also obtain an Associates degree in Industrial Chem Tech (ICT)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	50.0	50.0	50.0
	No	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q10 Semesters attended college before attaining BA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-8 semesters	1	50.0	50.0	50.0
	9-10 semesters	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q11 Enter the Chem or Biochem prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Transfer student from another college	1	50.0	50.0	50.0
	Transfer student from another program at Ferris	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q12 Prompted your interest in the Chem or Biochem prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	HS counselor or teacher	1	50.0	50.0	50.0
	FSU professor	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

q12a Other Specified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	100.0	100.0	100.0

q13 Immediate plans once you graduate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employment	2	100.0	100.0	100.0

q13a Other Specified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	100.0	100.0	100.0

q14 Staying in MI after graduation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	50.0	50.0	50.0
	Will depend on job offers/grad school acceptance	1	50.0	50.0	100.0
	Total	2	100.0	100.0	

15 Chem-Biochem APR Alumni Frequencies

Prepared by: Institutional Research & Testing, 08/15

Statistics

	N				
	Valid	Missing	Mean	Median	Std. Deviation
q1_1 Take at FSU: CHEM 121 General Chemistry 1	8	1	1.00	1.00	.000
q1_2 Take at FSU: CHEM 122 General Chemistry 2	8	1	1.00	1.00	.000
q1_3 Take at FSU: CHEM 231 Quantitative Analysis	8	1	1.00	1.00	.000
q1_4 Take at FSU: CHEM 321 Organic Chemistry 1	9	0	1.00	1.00	.000
q1_5 Take at FSU: CHEM 322 Organic Chemistry 2	9	0	1.00	1.00	.000
q1_6 Take at FSU: CHEM 364 Biochemistry	7	2	1.00	1.00	.000
q2a my background in chemistry is comparable	9	0	3.33	3.00	.500
q2b my laboratory experience is comparable	9	0	3.56	4.00	.527
q2c my problem solving skills are comparable	9	0	3.44	4.00	.726
q2d my critical thinking skills are comparable	9	0	3.33	3.00	.500
q2e my background in computer usage is comparable	9	0	3.11	3.00	.601
q2f my background in math is comparable	9	0	3.33	4.00	1.000
q2g my background in writing is comparable	9	0	3.22	3.00	.667
q2h my oral communication skills are comparable	9	0	3.11	3.00	.782
q2i my interpersonal communication skills are comparable	8	1	3.00	3.00	.535
q2j my background in social awareness is comparable	9	0	3.00	3.00	.707
q2k my background in cultural enrichment is comparable	9	0	3.22	3.00	.667
q3 Satisfaction w/ level of expertise of prog faculty in professional areas	9	0	3.67	4.00	.500
q4 Overall level of satisfaction with the program	9	0	3.44	3.00	.527
q5 One required course identify as most beneficial in your career	9	0	1.22	1.00	.441
q6 Which one	9	0			
q7 One required course identify as least beneficial in your career	9	0	1.78	2.00	.441
q8 Which one	9	0			
q9 Additional comments	9	0			
q10 Entered the program as	9	0	2.22	3.00	.972
q11 Which institution	9	0			
q12 Which Ferris program	9	0			
q13 Graduation year	9	0			
q14 Employment status	9	0	1.00	1.00	.000

Frequency Table

q1_1 Take at FSU: CHEM 121 General Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	8	88.9	100.0	100.0
Missing	Not Selected	1	11.1		
Total		9	100.0		

q1_2 Take at FSU: CHEM 122 General Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	8	88.9	100.0	100.0
Missing	Not Selected	1	11.1		
Total		9	100.0		

q1_3 Take at FSU: CHEM 231 Quantitative Analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	8	88.9	100.0	100.0
Missing	Not Selected	1	11.1		
Total		9	100.0		

q1_4 Take at FSU: CHEM 321 Organic Chemistry 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	9	100.0	100.0	100.0

q1_5 Take at FSU: CHEM 322 Organic Chemistry 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	9	100.0	100.0	100.0

q1_6 Take at FSU: CHEM 364 Biochemistry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	7	77.8	100.0	100.0
Missing	Not Selected	2	22.2		
Total		9	100.0		

q2a my background in chemistry is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	6	66.7	66.7	66.7
	Strongly Agree	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

q2b my laboratory experience is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	4	44.4	44.4	44.4
	Strongly Agree	5	55.6	55.6	100.0
	Total	9	100.0	100.0	

q2c my problem solving skills are comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	11.1	11.1	11.1
	Somewhat Agree	3	33.3	33.3	44.4
	Strongly Agree	5	55.6	55.6	100.0
	Total	9	100.0	100.0	

q2d my critical thinking skills are comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	6	66.7	66.7	66.7
	Strongly Agree	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

q2e my background in computer usage is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	11.1	11.1	11.1
	Somewhat Agree	6	66.7	66.7	77.8
	Strongly Agree	2	22.2	22.2	100.0
	Total	9	100.0	100.0	

q2f my background in math is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	11.1	11.1	11.1
	Somewhat Agree	3	33.3	33.3	44.4
	Strongly Agree	5	55.6	55.6	100.0
	Total	9	100.0	100.0	

q2g my background in writing is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	11.1	11.1	11.1
	Somewhat Agree	5	55.6	55.6	66.7
	Strongly Agree	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

q2h my oral communication skills are comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	2	22.2	22.2	22.2
	Somewhat Agree	4	44.4	44.4	66.7
	Strongly Agree	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

q2i my interpersonal communication skills are comparab

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	11.1	12.5	12.5
	Somewhat Agree	6	66.7	75.0	87.5
	Strongly Agree	1	11.1	12.5	100.0
	Total	8	88.9	100.0	
Missing	0	1	11.1		
Total		9	100.0		

q2j my background in social awareness is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	2	22.2	22.2	22.2
	Somewhat Agree	5	55.6	55.6	77.8
	Strongly Agree	2	22.2	22.2	100.0
	Total	9	100.0	100.0	

q2k my background in cultural enrichment is comparable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	11.1	11.1	11.1
	Somewhat Agree	5	55.6	55.6	66.7
	Strongly Agree	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

q3 Satisfaction w/ level of expertise of prog faculty in professional areas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	3	33.3	33.3	33.3
	Very Satisfied	6	66.7	66.7	100.0
	Total	9	100.0	100.0	

q4 Overall level of satisfaction with the program

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Satisfied	5	55.6	55.6	55.6
	Very Satisfied	4	44.4	44.4	100.0
	Total	9	100.0	100.0	

q5 One required course identify as most beneficial in your career

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	77.8	77.8	77.8
	No	2	22.2	22.2	100.0
	Total	9	100.0	100.0	

q6 Which one

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	22.2	22.2	22.2
	Any ICT class	1	11.1	11.1	33.3
	Biochemistry Labs	1	11.1	11.1	44.4
	Organic Chemistry	1	11.1	11.1	55.6
	Quantitative analysis	1	11.1	11.1	66.7
	Quantitative Analysis Lab course	1	11.1	11.1	77.8
	Quantitative analysis.	1	11.1	11.1	88.9
	There were actually two that have proven useful. 1) Organic Chemistry (taken with Dr. Adsmond) and 2) Physical chemistry	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

q7 One required course identify as least beneficial in your career

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	22.2	22.2	22.2
	No	7	77.8	77.8	100.0
	Total	9	100.0	100.0	

q8 Which one

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	55.6	55.6	55.6
	CHEM 390 Inorganic	1	11.1	11.1	66.7
	honors enrichment for freshman	1	11.1	11.1	77.8
	NA	1	11.1	11.1	88.9
	Principles of Genetics	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

q9 Additional comments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	44.4	44.4	44.4
	I can say that the majority of the required courses I took at Ferris have been beneficial to my career. I developed the skills and knowledge while attending Ferris that I needed to be a valuable employee for the environmental analytical laboratory I currently work at. Although my work consists mainly of general and quantitative chemistry, there are times where my background in biochemistry is very useful. I also believe very strongly that the Safety in the Chemical Lab course should be required for all Physical Sciences degrees. It is surprising how many people I have worked with that do not have a basic understanding of safety in the workplace, let alone a chemical environment.	1	11.1	11.1	55.6
	I personally think offering workshops, classes etc. for public speaking, personal finance, investing, job negotiation and other such life skills that a never taught. May not be linked directly to this degree but is rewarding for any advancement	1	11.1	11.1	66.7
	I think there needs to be more instrumentation associated with the degree and time working on these instruments. Employers look for at least one year experience on instrumentation and that's where I think the ICT program filled gaps for myself.	1	11.1	11.1	77.8
	I will make no donations to the University until my fellow Bulldogs are allowed to be armed on campus. (I make a lot of money.)	1	11.1	11.1	88.9
	One area where Ferris Grads excel in is the hands on application and knowledge in the laboratories. However, an area where Ferris Chem grads suffer is in higher level mathematics, specifically, integration, 2nd/3rd level calculus and equation derivation.	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

q10 Entered the program as

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	As a freshman	3	33.3	33.3	33.3
	As a transfer student	1	11.1	11.1	44.4
	From another program at Ferris	5	55.6	55.6	100.0
	Total	9	100.0	100.0	

q11 Which institution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		8	88.9	88.9	88.9
	Smc dowagiac, Glen oaks community college	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

q12 Which Ferris program

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	44.4	44.4	44.4
	Biochemistry	1	11.1	11.1	55.6
	Chemistry	2	22.2	22.2	77.8
	Pharmacy	1	11.1	11.1	88.9
	Pre-pharmacy, joined while enrolled in ICT	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

q13 Graduation year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2010	1	11.1	11.1	11.1
	2011	1	11.1	11.1	22.2
	2012	2	22.2	22.2	44.4
	2013	3	33.3	33.3	77.8
	2014	2	22.2	22.2	100.0
	Total	9	100.0	100.0	

q14 Employment status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed full-time	9	100.0	100.0	100.0

15 Chem-Biochem APR Faculty Frequencies

Prepared by: Institutional Research & Testing, 08/15

Statistics

	N				
	Valid	Missing	Mean	Median	Std. Deviation
q1a The student-to-faculty ratio is sufficient to permit optimum prog effectiveness	5	0	3.60	4.00	.548
q1b The program faculty has access to adequate funds for faculty development	5	0	3.60	4.00	.548
q1c The program has adequate leadership	5	0	3.80	4.00	.447
q1d Program safety procedures & resources are adequate	5	0	3.60	4.00	.548
q1e The program should use one instructor to teach lec & another to conduct lab	4	1	1.25	1.00	.500
q1f Summer courses are adequate to meet student progress needs	5	0	3.60	4.00	.548
q1g The programs need to interface w/ grad schools to assess undergrad needs	5	0	3.00	3.00	.707
q1h The faculty make good use of on-line tools for class assignments	5	0	2.80	3.00	.447
q1i The programs should offer some of its courses at off-camp locations such as other institutions & industrial sites	4	1	2.00	2.00	.816
q1j The programs are comparable to offerings at other universities	5	0	3.00	3.00	.707
q1k Support courses are relevant to program goals & student needs	4	1	3.25	3.00	.500
q1l Adequate office & clerical assistance available to support the programs	4	1	3.75	4.00	.500
q1m Equipment w/in the prog is representative of equipmt in undergrad progs in Chem &/or Biochm at other institutions	4	1	3.50	3.50	.577
q1n Materials & supplies are readily available to support quality instruction	5	0	3.60	4.00	.548
q1o Materials & supplies are in sufficient quantity to support quality instruction	5	0	3.60	4.00	.548
q1p The curriculum allows the student to specialize in areas of interest	4	1	2.25	2.50	.957
q1q The programs are recognized by other institutions as being a viable feeder for grad students	5	0	2.60	3.00	.548
q1r The programs are recognized by industry as a resource	5	0	3.60	4.00	.548
q1s Adequate funds are available for new equipment &/or equipmt repair	5	0	2.40	3.00	.894
q1t Fund allocation for faculty development is consistent w/ the programs' objectives & faculty input	5	0	3.20	3.00	.447
q1u The University has an effective system for job placement of student w/in the prog	4	1	2.50	3.00	1.000
q1v There is adequate cooperation & collegiality w/in the programs	5	0	3.20	3.00	.447

Statistics

	N		Mean	Median	Std. Deviation
	Valid	Missing			
q1w The flow/order of courses in the program is appropriate	5	0	3.60	4.00	.548
q1x The flow/order of the courses prepare the students for subsequent courses	5	0	3.60	4.00	.548
q1y The lecture room/lab facilities meet the faculty/prog needs	4	1	3.25	3.50	.957
q1z Students can take courses at other universities that transfer to these progs	5	0	3.20	3.00	.447
q2 The top two program strengths are	5	0			
q3 The top two program weaknesses are	5	0			
q4 Additional comments	5	0			

Frequency Table

q1a The student-to-faculty ratio is sufficient to permit optimum prog effectiveness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1b The program faculty has access to adequate funds for faculty development

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1c The program has adequate leadership

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	20.0	20.0	20.0
	Strongly Agree	4	80.0	80.0	100.0
	Total	5	100.0	100.0	

q1d Program safety procedures & resources are adequate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1e The program should use one instructor to teach lec & another to conduct lab

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	60.0	75.0	75.0
	Somewhat Disagree	1	20.0	25.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1f Summer courses are adequate to meet student progress needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1g The programs need to interface w/ grad schools to assess undergrad needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	20.0	20.0	20.0
	Somewhat Agree	3	60.0	60.0	80.0
	Strongly Agree	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q1h The faculty make good use of on-line tools for class assignments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	20.0	20.0	20.0
	Somewhat Agree	4	80.0	80.0	100.0
	Total	5	100.0	100.0	

q1i The programs should offer some of its courses at off-camp locations such as other institutions & industrial sites

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	20.0	25.0	25.0
	Somewhat Disagree	2	40.0	50.0	75.0
	Somewhat Agree	1	20.0	25.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1j The programs are comparable to offerings at other universities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	20.0	20.0	20.0
	Somewhat Agree	3	60.0	60.0	80.0
	Strongly Agree	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q1k Support courses are relevant to program goals & student needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	3	60.0	75.0	75.0
	Strongly Agree	1	20.0	25.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1l Adequate office & clerical assistance available to support the programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	20.0	25.0	25.0
	Strongly Agree	3	60.0	75.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1m Equipment w/in the prog is representative of equipmt in undergrad progs in Chem &/or Biochm at other institutions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	50.0	50.0
	Strongly Agree	2	40.0	50.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1n Materials & supplies are readily available to support quality instruction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1o Materials & supplies are in sufficient quantity to support quality instruction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1p The curriculum allows the student to specialize in areas of interest

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	20.0	25.0	25.0
	Somewhat Disagree	1	20.0	25.0	50.0
	Somewhat Agree	2	40.0	50.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1q The programs are recognized by other institutions as being a viable feeder for grad students

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	2	40.0	40.0	40.0
	Somewhat Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1r The programs are recognized by industry as a resource

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1s Adequate funds are available for new equipment &/or equipmt repair

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	20.0	20.0	20.0
	Somewhat Disagree	1	20.0	20.0	40.0
	Somewhat Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1t Fund allocation for faculty development is consistent w/ the programs' objectives & faculty input

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	4	80.0	80.0	80.0
	Strongly Agree	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q1u The University has an effective system for job placement of student w/in the prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	20.0	25.0	25.0
	Somewhat Agree	3	60.0	75.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1v There is adequate cooperation & collegiality w/in the programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	4	80.0	80.0	80.0
	Strongly Agree	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q1w The flow/order of courses in the program is appropriate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1x The flow/order of the courses prepare the students for subsequent courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	40.0	40.0	40.0
	Strongly Agree	3	60.0	60.0	100.0
	Total	5	100.0	100.0	

q1y The lecture room/lab facilities meet the faculty/prog needs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	20.0	25.0	25.0
	Somewhat Agree	1	20.0	25.0	50.0
	Strongly Agree	2	40.0	50.0	100.0
	Total	4	80.0	100.0	
Missing	0	1	20.0		
Total		5	100.0		

q1z Students can take courses at other universities that transfer to these progs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	4	80.0	80.0	80.0
	Strongly Agree	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q2 The top two program strengths are

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	20.0	20.0	20.0
	1) Rigor of upper level courses in biochemistry	1	20.0	20.0	40.0
	1) The Biochemistry program provides ample laboratory experience. 2) Most students in both programs are provided with a laboratory experience that mimics a research environment.	1	20.0	20.0	60.0
	Quality of instruction and quality of advising	1	20.0	20.0	80.0
	students can get personal one-on-one attention from faculty. Opportunity to take ICT classes	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q3 The top two program weaknesses are

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1) BA in Chemistry degree should be expanded to a BS degree, with more upper level courses in chemistry.	1	20.0	20.0	20.0
	1) Some sections of Organic Chem. and General Chemistry do not provide enough hands-on laboratory experience.	1	20.0	20.0	40.0
	faculty research is not properly supported thus limiting independent research opportunities for students. Support for instrument maintanance and updating is weak.	1	20.0	20.0	60.0
	I don't have idea of BA programs in other universities. However, I feel like with minor changes such as adding 1 or two courses (inorganic chemistry, advanced physical chemistry) these can be converted to BSc. which will have more recognition in industry.	1	20.0	20.0	80.0
	Options/electives and opportunities for students to do research projects	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

q4 Additional comments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	80.0	80.0	80.0
	Students in our Chemistry BA program are less likely to be as prepared for graduate study in chemistry as compared to students who have completed a BS degree at neighboring universities.	1	20.0	20.0	100.0
	Total	5	100.0	100.0	

15 Chem-Biochem APR Current Student Frequencies

Prepared by: Institutional Research & Testing, 08/15

Statistics

	N				
	Valid	Missing	Mean	Median	Std. Deviation
q1 Took or currently taking CHEM 121-122	7	0	1.00	1.00	.000
q2a Helped me learn basic facts & info about chem	7	0	3.86	4.00	.378
q2b Prepared me well for subsequent courses in chem	7	0	3.71	4.00	.488
q2c Improved my ability to think critically about chem	7	0	3.71	4.00	.488
q2d Lab experience enhanced my understanding of chem	6	1	3.33	3.50	.816
q2e Lab experience improved my lab skills	7	0	3.57	4.00	.535
q3 Took or currently taking CHEM 321-322	7	0	1.14	1.00	.378
q4a Helped me learn basic facts & info about chem	5	2	3.60	4.00	.894
q4b Prepared me well for subsequent courses in chem	5	2	3.20	4.00	1.304
q4c Improved my ability to think critically about chem	5	2	3.40	4.00	.894
q4d Lab experience enhanced my understanding of chem	5	2	3.00	3.00	1.225
q4e Lab experience improved my lab skills	5	2	3.40	3.00	.548
q5 Took or currently taking CHEM 231	6	1	1.33	1.00	.516
q6a Helped me learn basic facts & info about chem	4	3	3.75	4.00	.500
q6b Prepared me well for subsequent courses in chem	4	3	3.75	4.00	.500
q6c Improved my ability to think critically about chem	4	3	3.75	4.00	.500
q6d Lab experience enhanced my understanding of chem	4	3	3.75	4.00	.500
q6e Lab experience improved my lab skills	4	3	3.75	4.00	.500
q7 Took or currently taking CHEM 451	6	1	1.83	2.00	.408
q8a Helped me learn basic facts & info about chem	1	6	3.00	3.00	
q8b Prepared me well for subsequent courses in chem	1	6	3.00	3.00	
q8c Improved my ability to think critically about chem	1	6	4.00	4.00	
q8d Lab experience enhanced my understanding of chem	1	6	1.00	1.00	
q8e Lab experience improved my lab skills	1	6	1.00	1.00	
q9 Took or currently taking CHEM 317	6	1	1.67	2.00	.516
q10a Helped me learn basic facts & info about chem	2	5	3.00	3.00	1.414
q10b Prepared me well for subsequent courses in chem	2	5	3.50	3.50	.707
q10c Improved my ability to think critically about chem	2	5	3.50	3.50	.707
q10d Lab experience enhanced my understanding of chem	2	5	4.00	4.00	.000
q10e Lab experience improved my lab skills	2	5	4.00	4.00	.000
q11 Took or currently taking CHEM 364 (Biochemistry)	6	1	1.67	2.00	.516
q12a Helped me learn basic facts & info about chem	2	5	4.00	4.00	.000
q12b Prepared me well for subsequent courses in chem	2	5	4.00	4.00	.000
q12c Improved my ability to think critically about chem	1	6	4.00	4.00	
q13 Took or currently taking CHEM 332-333	6	1	2.00	2.00	.000
q14a Helped me learn necessary biochem lab skills	0	7			
q14b Prepared me well for subsequent lab work	0	7			
q14c Improved my ability to think critically about experimental design	0	7			
q15 Took or currently taking CHEM 474	6	1	2.00	2.00	.000
q16a Helped me learn basic facts & info about biochem	0	7			
q16b Prepared me well for subsequent experiences in my discipline	0	7			
q16c Improved my ability to think critically about biochem	0	7			
q17a The lecture facilities are sufficient	6	1	3.67	4.00	.516
q17b The lecture facilities are of good quality	6	1	3.67	4.00	.516
q17c The lab facilities are sufficient	6	1	3.33	3.50	.816
q17d The lab facilities are of good quality	6	1	2.67	2.00	1.033

Statistics

	N		Mean	Median	Std. Deviation
	Valid	Missing			
q17e The library facilities for chemistry (including electronic resources) are sufficient	6	1	3.17	3.00	.408
q17f The library facilities for chemistry (including electronic resources) are of good quality	6	1	3.17	3.00	.408
q17g The opportunities for developing computer skills are sufficient	6	1	2.50	2.50	1.049
q18 The presence of the ACS Student Affiliate enhanced my Chem experience	6	1	2.50	2.50	1.049
q19 The Chem or Biochem prog is serving my needs for the future	6	1	3.33	3.00	.516
q20 Recommend Chem or Biochem prog to prospective student	6	1	1.33	1.00	.816
q21 Additional comments	7	0			
q22 Degree program enrolled in	6	1	1.17	1.00	.408
q23 Additionally enrolled in the ICT program	6	1	1.50	1.50	.548
q24 Academic status	6	1	3.67	4.00	.816
q24a Other Specified	7	0			
q25 Expected calendar year of graduation	6	1	1.67	1.50	.816
q26 Find out about Chem or Biochem prog	6	1	2.33	2.00	.516
q26a Other Specified	7	0			
q27 Enter Chem or Biochem prog	6	1	2.17	2.50	.983
q28 Which institution	7	0			
q29 Which Ferris program	7	0			
q30_1 Immediate goals: Professional employment	3	4	1.00	1.00	.000
q30_2 Immediate goals: Pharmacy school	0	7			
q30_3 Immediate goals: Medical, Dental, Optometry school	0	7			
q30_4 Immediate goals: Grad school in Chem, Biochem, or closely related field	3	4	1.00	1.00	.000
q30_5 Immediate goals: Grad school in an unrelated field	1	6	1.00	1.00	
q30_6 Immediate goals: Other	0	7			
q30a Other Specified	7	0			

Frequency Table

q1 Took or currently taking CHEM 121-122 (General Chem)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	100.0	100.0	100.0

q2a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	14.3	14.3
	Strongly Agree	6	85.7	85.7	100.0
	Total	7	100.0	100.0	

q2b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	28.6	28.6	28.6
	Strongly Agree	5	71.4	71.4	100.0
	Total	7	100.0	100.0	

q2c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	28.6	28.6	28.6
	Strongly Agree	5	71.4	71.4	100.0
	Total	7	100.0	100.0	

q2d Lab experience enhanced my understanding of chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	14.3	16.7	16.7
	Somewhat Agree	2	28.6	33.3	50.0
	Strongly Agree	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q2e Lab experience improved my lab skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	3	42.9	42.9	42.9
	Strongly Agree	4	57.1	57.1	100.0
	Total	7	100.0	100.0	

q3 Took or currently taking CHEM 321-322 (Organic Chem)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	85.7	85.7	85.7
	No	1	14.3	14.3	100.0
	Total	7	100.0	100.0	

q4a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	14.3	20.0	20.0
	Strongly Agree	4	57.1	80.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

q4b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	20.0	20.0
	Somewhat Agree	1	14.3	20.0	40.0
	Strongly Agree	3	42.9	60.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

q4c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	14.3	20.0	20.0
	Somewhat Agree	1	14.3	20.0	40.0
	Strongly Agree	3	42.9	60.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

q4d Lab experience enhanced my understanding of chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	20.0	20.0
	Somewhat Agree	2	28.6	40.0	60.0
	Strongly Agree	2	28.6	40.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

q4e Lab experience improved my lab skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	3	42.9	60.0	60.0
	Strongly Agree	2	28.6	40.0	100.0
	Total	5	71.4	100.0	
Missing	System	2	28.6		
Total		7	100.0		

q5 Took or currently taking CHEM 231 (Quantitative Analysis)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	57.1	66.7	66.7
	No	2	28.6	33.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q6a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	25.0	25.0
	Strongly Agree	3	42.9	75.0	100.0
	Total	4	57.1	100.0	
Missing	System	3	42.9		
Total		7	100.0		

q6b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	25.0	25.0
	Strongly Agree	3	42.9	75.0	100.0
	Total	4	57.1	100.0	
Missing	System	3	42.9		
Total		7	100.0		

q6c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	25.0	25.0
	Strongly Agree	3	42.9	75.0	100.0
	Total	4	57.1	100.0	
Missing	System	3	42.9		
Total		7	100.0		

q6d Lab experience enhanced my understanding of chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	25.0	25.0
	Strongly Agree	3	42.9	75.0	100.0
	Total	4	57.1	100.0	
Missing	System	3	42.9		
Total		7	100.0		

q6e Lab experience improved my lab skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	25.0	25.0
	Strongly Agree	3	42.9	75.0	100.0
	Total	4	57.1	100.0	
Missing	System	3	42.9		
Total		7	100.0		

q7 Took or currently taking CHEM 451 (Intro to Physical Chem)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	14.3	16.7	16.7
	No	5	71.4	83.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q8a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q8b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q8c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q8d Lab experience enhanced my understanding of chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q8e Lab experience improved my lab skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q9 Took or currently taking CHEM 317 (Instrumental Analysis)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	28.6	33.3	33.3
	No	4	57.1	66.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q10a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	14.3	50.0	50.0
	Strongly Agree	1	14.3	50.0	100.0
	Total	2	28.6	100.0	
Missing	System	5	71.4		
Total		7	100.0		

q10b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	50.0	50.0
	Strongly Agree	1	14.3	50.0	100.0
	Total	2	28.6	100.0	
Missing	System	5	71.4		
Total		7	100.0		

q10c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	1	14.3	50.0	50.0
	Strongly Agree	1	14.3	50.0	100.0
	Total	2	28.6	100.0	
Missing	System	5	71.4		
Total		7	100.0		

q10d Lab experience enhanced my understanding of chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	2	28.6	100.0	100.0
Missing	System	5	71.4		
Total		7	100.0		

q10e Lab experience improved my lab skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	2	28.6	100.0	100.0
Missing	System	5	71.4		
Total		7	100.0		

q11 Took or currently taking CHEM 364 (Biochemistry)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	28.6	33.3	33.3
	No	4	57.1	66.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q12a Helped me learn basic facts & info about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	2	28.6	100.0	100.0
Missing	System	5	71.4		
Total		7	100.0		

q12b Prepared me well for subsequent courses in chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	2	28.6	100.0	100.0
Missing	System	5	71.4		
Total		7	100.0		

q12c Improved my ability to think critically about chem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	1	14.3	100.0	100.0
Missing	System	6	85.7		
Total		7	100.0		

q13 Took or currently taking CHEM 332-333 (Biochem/Lab 1 & 2)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	6	85.7	100.0	100.0
Missing	System	1	14.3		
Total		7	100.0		

q14a Helped me learn necessary biochem lab skills

		Frequency	Percent
Missing	System	7	100.0

q14b Prepared me well for subsequent lab work

		Frequency	Percent
Missing	System	7	100.0

q14c Improved my ability to think critically about experimental design

		Frequency	Percent
Missing	System	7	100.0

q15 Took or currently taking CHEM 474 (Advanced Biochem)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	6	85.7	100.0	100.0
Missing	System	1	14.3		
Total		7	100.0		

q16a Helped me learn basic facts & info about biochem

		Frequency	Percent
Missing	System	7	100.0

q16b Prepared me well for subsequent experiences in my discipline

		Frequency	Percent
Missing	System	7	100.0

q16c Improved my ability to think critically about biochem

		Frequency	Percent
Missing	System	7	100.0

q17a The lecture facilities are sufficient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	28.6	33.3	33.3
	Strongly Agree	4	57.1	66.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17b The lecture facilities are of good quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	2	28.6	33.3	33.3
	Strongly Agree	4	57.1	66.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17c The lab facilities are sufficient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	1	14.3	16.7	16.7
	Somewhat Agree	2	28.6	33.3	50.0
	Strongly Agree	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17d The lab facilities are of good quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Disagree	4	57.1	66.7	66.7
	Strongly Agree	2	28.6	33.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17e The library facilities for chemistry (including electronic resources) are sufficient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	5	71.4	83.3	83.3
	Strongly Agree	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17f The library facilities for chemistry (including electronic resources) are of good quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	5	71.4	83.3	83.3
	Strongly Agree	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q17g The opportunities for developing computer skills are sufficient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	16.7	16.7
	Somewhat Disagree	2	28.6	33.3	50.0
	Somewhat Agree	2	28.6	33.3	83.3
	Strongly Agree	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q18 The presence of the ACS Student Affiliate enhanced my Chem experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	14.3	16.7	16.7
	Somewhat Disagree	2	28.6	33.3	50.0
	Somewhat Agree	2	28.6	33.3	83.3
	Strongly Agree	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q19 The Chem or Biochem prog is serving my needs for the future

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat Agree	4	57.1	66.7	66.7
	Strongly Agree	2	28.6	33.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q20 Recommend Chem or Biochem prog to prospective student

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	71.4	83.3	83.3
	Possibly in the future as the program grows	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q21 Additional comments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		7	100.0	100.0	100.0

q22 Degree program enrolled in

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Chemistry BA	5	71.4	83.3	83.3
	Biochemistry BA	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q23 Additionally enrolled in the ICT program

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	42.9	50.0	50.0
	No	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q24 Academic status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sophomore	1	14.3	16.7	16.7
	Senior	5	71.4	83.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q24a Other Specified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		7	100.0	100.0	100.0

q25 Expected calendar year of graduation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2016	3	42.9	50.0	50.0
	2017	2	28.6	33.3	83.3
	2018	1	14.3	16.7	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q26 Find out about Chem or Biochem prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ferris literature (any form including on-line)	4	57.1	66.7	66.7
	Ferris faculty or staff	2	28.6	33.3	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q26a Other Specified

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7	100.0	100.0	100.0

q27 Enter Chem or Biochem prog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Straight in	2	28.6	33.3	33.3
	Transferred from another institution	1	14.3	16.7	50.0
	Transferred from another Ferris program	3	42.9	50.0	100.0
	Total	6	85.7	100.0	
Missing	System	1	14.3		
Total		7	100.0		

q28 Which institution

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7	100.0	100.0	100.0

q29 Which Ferris program

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	71.4	71.4	71.4
	Chemistry	1	14.3	14.3	85.7
	Pre-Pharmacy	1	14.3	14.3	100.0
	Total	7	100.0	100.0	

q30_1 Immediate goals: Professional employment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	42.9	100.0	100.0
Missing	Not Selected	4	57.1		
Total		7	100.0		

q30_2 Immediate goals: Pharmacy school

		Frequency	Percent
Missing	Not Selected	7	100.0

q30_3 Immediate goals: Medical, Dental, Optometry school

		Frequency	Percent
Missing	Not Selected	7	100.0

q30_4 Immediate goals: Grad school in Chem, Biochem, or closely related field

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	3	42.9	100.0	100.0
Missing	Not Selected	4	57.1		
Total		7	100.0		

q30_5 Immediate goals: Grad school in an unrelated field

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Selected	1	14.3	100.0	100.0
Missing	Not Selected	6	85.7		
Total		7	100.0		

q30_6 Immediate goals: Other

		Frequency	Percent
Missing	Not Selected	7	100.0

q30a Other Specified

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		7	100.0	100.0	100.0

Appendix VI
Curriculum Vitae

DANIEL A. ADSMOND – Curriculum Vitae

Education

B.S. Chemistry, Northern Michigan University, Cum Laude, 4/82

Ph.D., Chemistry, University of Minnesota, 4/91 Advisor: Margaret C. Etter, Thesis title: "Designing and Synthesizing Organic Crystals with Aminopyrimidine Building Blocks"

Employment History

Aldrich Chemical Company, Synthetic Organic Chemist 1983-1985
University of Minnesota, Graduate Teaching Assistant, Department of Chemistry 1985-1987
University of Minnesota, Graduate Research Assistant, Department of Chemistry 1987-1991
University of Minnesota, Postdoctoral Research Associate, Department of Pharmaceutics 1991-1992
Morehead State University, Assistant Professor of Chemistry 1992-97
Morehead State University, Associate Professor of Chemistry 1997-98
Ferris State University, Assistant Professor of Chemistry 1998- 2001
Ferris State University, Associate Professor of Chemistry 2001 - 2006
Ben Gurion University of the Negev, Beer Sheva, Israel, Visiting Research Scientist, 2006-2007
Ferris State University, Professor of Chemistry 2006 – present
University College Cork, Cork, Ireland, Visiting Research Scientist, September-December 2014

Scholarly and Professional Activities

Sabbatical
2014 Fall semester, research in ternary cocrystallization, University College Cork, Cork, Ireland

2006-2007 academic year spent carrying out research in solid-state organic chemistry at Ben Gurion University of the Negev, Beer Sheva, Israel.

Refereed Publications
"Polymorphic Co-crystals from Polymorphic Co-crystal Formers: Competition between Carboxylic Acid-Pyridine and Phenol-Pyridine Hydrogen Bonds," A. Lemmerer, D. Adsmond, C. Esterhuysen, J. Bernstein, *Crystal Growth & Design*, **2013**, *13* (9), 3935–3952.

"Maximizing Scientific Thought through the Design of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course, D. Adsmond, *Chemica nella Scuola, Rivista CnS: Speciale n. 3* -**2012**.

"An Investigation of the Hydrogen-Bond Peferences and Co-crystallization Behavior of Three Didonor Compounds," A. Lemmerer, D. Adsmond, J. Bernstein, *Crystal Growth & Design*, **2011**, *11* (5), 2011–2019.

"Hydrogen Bonding in Sulfonamides," D. Adsmond, D. Grant, *J. Pharm. Sci*., **2001**, 90, 2058-2077.

"Relationships Between Solution Thermodynamics and Hydrogen-Bond Patterns of Crystalline Dialkylhydroxypyridone Iron Chelators and their Formic Acid Solvates," S. Ghosh, D. Adsmond, D. Grant, *J. Pharm. Sci*., **1995**, 84, 568-574.

"Hydrogen-Bond Patterns of Dialkylpyridone Iron Chelators and their Formic Acid Solvates: Description, Prediction, and Role in Crystal Packing," S. Ghosh, D. Adsmond, J. Huotari, D. Grant, *J. Pharm. Sci*., **1993**, 82, 901-911.

"The Use of Cocrystallization as a Method of Studying Hydrogen-Bond Preferences of 2-Aminopyrimidine," M. Etter, D. Adsmond, *J. Chem Soc., Chemical Communications*, **1990**, 8, 589-591.

"Using Hydrogen Bonds to Design Acentric Organic Materials for Nonlinear Optical Users," M. Etter, G. Frankenbach, D. Adsmond, *Mol Cryst. Liq. Cryst*., **1990**, 187, 25-39.

"2-Aminopyrimidine-Succinic Acid (1/1) Cocrystal," M. Etter, D. Adsmond, D. Britton, *Acta Cryst*., **1990**, C46, 933-934.

Submitted Manuscript

"Design and Synthesis of Ternary Cocrystals Using Carboxyphenols and Two Complementary Acceptor Compounds," D. Adsmond, A. Sinha, U. Khandaville, A.Maguire, S. Lawrence, submitted to Crystal Growth and Design, July 2015.

Invited Plenary Presentations

"Design and Goals of the FSU Chemistry BA Program," European Chemistry Thematic NetworkAssociation, International Scientific School, Association Kazan National Research Technological University, Kazan, Russia, Oct 27-31, 2014.

"Chemistry Lecture and Laboratory Goals and Course Design," European Chemistry Thematic Network Association, International Scientific School, Kazan National Research Technological University, Kazan, Russia, Oct 27-31, 2014.

"A Collaborative Research-based Organic Chemistry 2 Laboratory Course," European Chemistry Thematic Network Association, International Scientific School, Kazan National Research Technological University, Kazan, Russia, Oct 27-31, 2014.

"Techniques for Increasing Student Involvement in the Chemistry Lecture," European Chemistry Thematic Network Association, International Scientific School, Kazan National Research Technological University, Kazan, Russia, Oct 27-31, 2014.

Conference Sessions Organized and Chaired

Organized and chaired session entitled "Molecular Modeling in the Classroom," at the American Chemical Society National Meeting, Anaheim, California, , March 21-25, 1999.

Conference Presentations

"An Investigation of the Ability of Sulfisomidine to form Cocrystals with with Carboxylic Acids," S. Douglas, D. Adsmond, American Chemical Society National Meeting, Denver, CO, March 2015.

"An Investigation of the Ability of Dibenzylsulfoxide and Triphenylphosphine oxide to form Cocrystals with Carboxyphenols," C. Kemppainen, D. Adsmond, American Chemical Society National Meeting, Denver, CO, March 2015.

"Saccharin Cocrystallization," D. Birdsall, D. Adsmond, American Chemical Society National Meeting, New Orleans, LA, April 2013.

"Maximizing Scientific Thought through the Design of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course, D. Adsmond, 22nd International Conference on Chemistry Education, Rome, Italy, July 2012.

"Cocrystallization of Sulfamethazine with 20 Carboxylic Acids," B. Q. Wierckz, D. Adsmond, American Chemical Society National Meeting, San Diego, CA, March 2012.

"Maximizing Engagement in the Laboratory: A Retrospective on 7 Years of a Collaborative Research-based Organic Chemistry 2 Laboratory Course, D. Adsmond, Lilly Conference on College and University Teaching, Traverse City, MI, Sept 2010.

"Predicted and Unpredicted Cocrystals of m-Hydroxybenzoic Acid and Acridine," D. Adsmond, J. Bernstein, and R. Vainer, American Crystallographic Association Meeting, Toronto, Ontario, July 2009.

"Evaluation of a 2-year Pilot of a Collaborative Research-based Organic Chemistry 2 Laboratory Course at Ferris State University," D. Adsmond, P. Balanda, and D. Frank, Gordon Research Conference on Chemical Education: Research and Practice, New London, Connecticut, June 2005.

"Outcomes and Analysis of a 2-Year Pilot of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course at Ferris State University," D. Adsmond, P. Balanda, and D. Frank, 228th ACS National Meeting, NSF Symposium, Philadelphia, Pennsylvania, Aug 2004.

"Implementation of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course at Ferris State University," D. Adsmond, P. Balanda, and D. Frank, 18th Biennial Conference on Chemical Education, Ames, Iowa, July 2004.

"A Student Investigation of Sulfa Drug/Carboxylic Acid Molecular Recognition by Cocrystallization," D. Adsmond; M. Whitener, and P. Squattrito, XIXth General Assembly and Conference of the International Union of Crystallography, Geneva, Switzerland, Aug 2002.

"An Investigation of the Effects of Molecular Changes on the Binding Preferences of Amidines," D. Adsmond and D. Grabill, American Chemical Society Great Lakes/Central Regional Meeting, Grand Rapids, Michigan, June 2001.

"A Research Experience for Students in the Second Semester of Organic Chemistry at Ferris State University," D. Adsmond, Biennial Conference on Chemical Education, Ann Arbor, Michigan, Aug 2000.

"A Student Investigation of the Molecular Recognition between Sulfa Drugs and Carboxylic Acids by Cocrystallization," D. Adsmond and M. Whitener, American Crystallographic Association Annual Meeting, St. Paul, Minnesota, July 2000.

"Comparison of the Hydrogen-Bond Patterns of Sulfapyridine/Acetic Acid 1:1 Solvate with Related Structures," S. Gorrell, D. Adsmond, and M. Whitener, American Crystallographic Association Annual Meeting, Arlington, VA; July. 1998.

"A Four-week Research and Development Team Project for the Organic Chemistry Laboratory," D. Adsmond, Kentucky Academy of Science 83rd Annual Meeting, Morehead State University, Morehead, Kentucky, Nov 1997.

"An Analysis of the Hydrogen-bond Patterns Observed in Acetic Acid Solvates," S. Gorrell and D. Adsmond, Kentucky Academy of Science 83rd Annual Meeting, Morehead State University, Morehead, Kentucky, Nov 1997.

"An Analysis of the Hydrogen-bond Prefereences of Acetic Acid in Solvates of Neutral Organic Hosts," J. Underwood and D. Adsmond, 8th Midwest Organic Solid-State Chemistry Conference, University of Nebraska, Lincoln, Nebraska, June 1996.

"What kind of a Molecule Would Let Acetic Acid be Included in its Crystal?" J. Underwood and D. Adsmond, Kentucky Academy of Science 83rd Annual Meeting, Kentucky State University, Frankfort, Kentucky, Nov 1996.

"An Investigation of Hydrogen Bond Preferences of Amidine Functionalities and Carboxylic Acid Groups by Cocrystallization," K. Thomas and D. Adsmond, 7th Midwest Organic Solid-State Chemistry Conference, Bloomington, Indiana, June 1995.

"Student Design of Projects for Freshman Chemistry," D. Adsmond and Z. Barnes, 13th Biennial Conference on Chemical Education, Lewisburg, Pennsylvania, July1994.

"Graph-set Analysis of Hydrogen-bond Patterns in Polymorphs of Two Sulfa Drugs," D. Adsmond and D. Grant, 6th Midwest Organic Solid-State Chemistry Conference, Minneapolis, Minnesota, June 1994.

Graph-set Analysis of Hydrogen-bond Patterns in Polymorphs of Two Sulfa Drugs," D. Adsmond, American Crystallographic Association Annual Meeting, Atlanta, Georgia, June 1994.

"Scientific Method and Classification Skills for Middle School," Z. Barnes and D. Adsmond, workshop at National Science Teachers Association 1993 Area Convention, Louisville, Kentucky, Nov 1993.

"Investigation and Modification of Complexation Behavior of Aminopyrimidines in the Solid State," D. Adsmond, invited lecture at University of Kentucky, Lexington, Kentucky, April 1993.

"Hydrogen Bond Directed Molecular Recognition in Organic Crystals," D. Adsmond and M. Etter, Kentucky Academy of Science, 78th Annual Meeting, Ashland, Kentucky, Oct 1992.

"Hydrogen-bond Selectivity in Asymmetrically Substituted Aminopyrimidines," D. Adsmond, 32nd National Organic Chemistry Symposium, University of Minnesota, Minneapolis, MN, June 1991.

"Predicting, Synthesizing, and Analyzing Organic Cocrystals Formed by Solid-State Methods," D. Adsmond, 2nd Midwest Organic Solid-State Chemistry Conference, Minneapolis, Minnesota, June 1989.

"Predicting and Analyzing Hydrogen-bond Patterns of 2-Aminopyrimidines," D. Adsmond and M. Etter, American Crystallographic Association Annual Meeting, Seattle, Washington, July 1989. (winner of Linus Pauling Prize for best student poster).

Local Student Research Presentation Events

"Chemistry on the Bridge," planned and executed a public poster presentation session where 60-90 students of Organic Chemistry presented the results of their laboratory research. (2006, 2008- 2012)

College of Arts and Sciences Student Recognition Event, 11 student research posters in 2011, 8 student research poster presentations in 2012.

Grants & Fellowships

"Finding the Sweet Spot for Ternary Cocrystal Formation," D. Adsmond, J. Reardon, Ferris State University, Academic Affairs, Student Research Fellowship, funded, Summer 2015.

"An Investigation of the Ability of Dibenzylsulfoxide to form Cocrystals with Carboxylic Acids and Phenols," D. Adsmond, C. Kemppainen, Ferris State University, Academic Affairs, Student Research Fellowship, funded, Summer 2015.

"An Investigation of the Ability of Sulfisomidine to form Cocrystals with Carboxylic Acids," D. Adsmond, S. Douglas, Ferris State University, Academic Affairs, Student Research Fellowship, funded, Summer 2015.

"Determination and Analysis of Crystal Packing in Cocrystals Incorporating the Antibacterial Drug, Sulfamethazine, and a Carboxylic Acid," D. Adsmond, Ferris State University, Academic Affairs, Faculty Research Fellowship, funded 25% release time Spring 2013-Fall 2013.

"Growth of X-ray Quality Sulfamethazine Cocrystals and Analysis of the Crystal Packing," D. Adsmond, B. Wierckz, Ferris State University, Academic Affairs, Student Research Assistantship, funded $1500, Spring 2013.

"An Investigation of the Cocrystallization Behavior of Saccharin," D. Adsmond, D. Birdsall, Ferris State University, Academic Affairs, Student Research Fellowship, funded $5500, Summer 2012.

"Assessing the Influence of Carboxylic Acid Structure and Crystallization Conditions on Acid:Amidine Cocrystal Formation" D. Adsmond, B. Wierckz, Ferris State University, Academic Affairs, Student Research Fellowship, funded $4500, Summer 2011.

"The Rational Design, Synthesis, and Analysis of Ternary Cocrystals," D. Adsmond, Ferris State University Research Grant, funded $10,984, 2006 – 2007.

"FT-NMR Upgrade for a Collaborative Research-Based Organic Chemistry 2 Laboratory Course: Development and Implementation" D. Adsmond, P. Balanda, D. Frank, National Science Foundation, funded $46,676, March 13, 2002.

"Funding for the Instrument Support for a Collaborative Research-Based Organic Chemistry Laboratory" D. Adsmond, Exceptional Merit Faculty/Staff Award funded by the Ferris Foundation, funded $5,000 April 29, 2002.

"FT-NMR Upgrade for a Collaborative Research-Based Organic Chemistry 2 Laboratory" D. Adsmond, Dean's Initiative Grant, funded $1000 February 2002.

"Release Time for Grant Proposal Writing, Application to the National Science Foundation for Funds to Upgrade Ferris State University's Chemistry Laboratory Instrumentation," D. Adsmond, Faculty Grant Development Fund grant, funded $2500 release time for January 2001-May 2001.

"An Investigation of the Effect of Molecular Change on Binding Preferences of Amidines" D. Adsmond, Ferris research grant, funded $2950 May 2000.

"An Investigation of the Effect of Molecular Change on Binding Preferences of Amidines" D. Adsmond, Ferris State University research grant, funded $2950, 2000.

"Development and Implementation of a Research Experience for Students in the Organic Chemistry Laboratory," D. Adsmond, P. Balanda, Ferris State University professional development grant, funded $3066, 1999.

"Characterization of New Acetic Acid Solvates and Studies of Acetic Acid Binding Interactions," D. Adsmond, Morehead State University research grant, funded $4406, 1997.

"An Investigation of the Preferences and Binding Modes of Acetic Acid in Solvate Formation," D. Adsmond, Morehead State University research grant, funded $3213, 1995.

Editor

Guest Editor for special issue of Crystal Growth and Design honoring Margaret C. Etter, 2014-2015.

Manuscript Review

Reviewer for the Journal of Pharmaceutical Sciences, Crystal Growth and Design, & CrystEngComm: 3 manuscripts in 2002, 1 manuscript in 2003, 1 manuscript in 2005, 3 manuscripts in 2006, 1 manuscript in 2008, 1 manuscript in 2009, 2 manuscripts in 2010, 1 manuscript in 2011, 2 manuscripts in 2012, 2 manuscripts in 2013, 2 manuscripts in 2015.

Memberships

American Chemical Society, American Crystallographic Association

Teaching Awards

Ferris State University Distinguished Teacher Award 2009

Ferris State University Outstanding Professor Award by Honors Students 2005

Research Interests

hydrogen-bonding, molecular recognition, graph sets, solvate formation, cocrystalization, polymorphism, pharmaceutical solids, and organic materials.

Teaching Interests

organic chemistry, cooperative and problem-based learning, collaborative laboratory research projects.

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ACADEMIC EXPERIENCE:

Professor of Chemistry (2008-present) Associate Professor (2003-2008) Assistant Professor (1998-2003)	Physical Sciences Department, Ferris State University, Big Rapids, MI. Teach/taught: Fund of Organic Chemistry. Organic Chemistry 1, Organic Chemistry 2, Fund Organic-Polymer Chemistry, Intro Organic-Biochemistry, and Fund of Biochemistry.
Postdoctoral Associate (1997-1998)	Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA. Studied thermodynamics of host-guest complexations with Professor Harry Gibson.
Research assistant (1992-1997)	Department of Chemistry, University of Florida, Gainesville, FL. Carried on independent research. Established and maintained a thirteen lab and office computer network.
Teaching Assistant (1991-1992, 1996-1997)	Department of Chemistry, University of Florida.
Teaching Assistant (1988-1991)	Department of Chemistry, Central Michigan University; Outstanding Teaching Assistant Award, 1989-1990.
Secondary Science Teacher (1987-1988)	Murray-Wright High School, Detroit, MI. Taught high school chemistry and biology. Acquired an interest in polymer chemistry.
Substitute Teacher (1986-1987)	L'Anse Creuse Public Schools, Harrison Twp., MI

EDUCATION:

University of Florida (1991-1997)	Ph.D. in organic polymer chemistry. Research advisor: Professor John R. Reynolds. Thesis title: "Synthesis of Functionalized Poly(*p*-Phenylene)s *via* Palladium Acetate Catalyzed Suzuki Cross-Coupling Polymerization"
Central Michigan University (1988-1991)	Undergraduate and graduate course work in chemistry with independent research involving monomer and polymer synthesis with Professor Dillip Mohanty. Outstanding Teaching Assistant, 1990

Wayne State University (1986-1988)	Secondary high school teaching certification
Macomb Community College (1985)	Emergency medical technology certification
Albion College (1980-1983)	Liberal arts curriculum. B.A. in biology; member Beta-Beta-Beta Biological Honor Society; recipient Albion Presidential Award; graduated *cum laude*
L'Anse Creuse High School (1976-1980)	Salutatorian; National Honor Society; varsity tennis

PROFESSIONAL AFFILIATIONS:

American Chemical Society: Member (1989-present): Division of Organic Chemistry; Division of Chemical Education

International Alliance of Teacher Scholars: Member (2000-2002)

PUBLICATIONS & PRESENTATIONS:

Hull, B.; Balanda, P. "Towards the Synthesis of Bisbenzoxazoles from Resorcinol," Midwestern Symposium on Undergraduate Research in Chemistry, Michigan State University, October 11, 2014 & Hull, B.; Balanda, P. "Towards the Synthesis and Polymerization of Benzoxazole from Resorcinol," Research Fellowship, Ferris State University, August 21, 2014

Taylor, D.; Balanda, P. "Towards the Synthesis of Bisbenzoxazoles from Hydroquinone," 2014 Student Research Fellowship, Ferris State University, August 21, 2014

Hull, B.; Balanda, P.B. "One Pot Amidation of Anisole with Isobutyric Acid and Hydroxylamine in Polyphosphoric Acid," CAS Student Poster Session, Ferris State University, May 2, 2014

Balanda, P.B. "A Semi-quantitative Analysis of the Effect of Relative Monomer Concentrations on Rate of Copolymerization and Copolymer Composition in Styrene and Methyl Methacrylate Bulk Polymerization/Copolymerization for the Undergraduate Laboratory," 21st Biennial Conference on Chemical Education, August 1, 2010–August 5, 2010, University of North Texas, Denton, Texas

Adsmond, D.; Balanda, P.B.; Frank, D. "Evaluation of a 2-year pilot of a collaborative research-based Organic Chemistry 2 laboratory course at FSU," Gordon Research Conference on Chemistry Education Research and Practice, June 2005

Adsmond, D.; Balanda, P.B.; Frank, D. "Outcomes and Analysis of a 2-Year Pilot of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course at FSU," 228th ACS National Meeting, NSF Symposium, Aug 2004

Balanda, P.B.; Adsmond, D.; Frank, D. "Research Projects in an Organic Chemistry 2 Laboratory," 18th Biennial Conference on Chemical Education, Ames, Iowa, July 21, 2004

Adsmond, D.; Balanda, P.B.; Frank, D. "Implementation of a Collaborative Research-Based Organic Chemistry 2 Laboratory Course at Ferris State University" 18th Biennial Conference on Chemical Education, Ames, Iowa, July 21, 2004

Balanda, P.B. "A Project-Driven One-Semester Introduction to Organic and Polymer Chemistry" 16th Biennial Conference of Chemical Education, Ann Arbor, MI, August 2, 2000

Balanda, P.B.; Ramey, M.B.; Reynolds, J.R. "Water Soluble and Blue Luminescent Cationic Polyelectrolytes Based on Poly(*p*-Phenylene)," *Macromolecules*, **1999**, *32*, 3970

Gong, C.; Balanda, P.B.; Gibson, H.W. "Supramolecular Chemistry with Macromolecules: New Self-Assembly based Main Chain Polypseudorotaxanes and Their Properties," *Macromolecules*, **1998**, *31*, 5278

Baur, J.W.; Kim, S.; Balanda, P.B.; Reynolds, J.R.; Rubner, M.F. "Thin-Film Light Emitting Devices Based on Sequentially Adsorbed Multilayers of Water-Soluble Poly(*p*-Phenylene)s." *Adv. Mater.* **1998**, *10*, 1452

Balanda, P.B.; Reynolds, J.R. "Functionalized Poly(*p*-Phenylene)s via Suzuki Cross-coupling" *Am. Chem. Soc., Proc. Div. Polym. Mats. Sci. Eng.* **1997**, *76*, 252

Balanda, P.B.; Reynolds, J.R. "Methoxyethoxy- and Triethoxy- Substituted Poly(*p*-Phenylene)s via Suzuki Cross-coupling" *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **1996**, *37*(1), 528-529

Spangler, C.W.; Zhu, L.; Lu, Z.; He, M.; Balanda, P.B.; Reynolds, J.R. "Synthesis, Characterization and Oxidative Doping Behavior of Copolymers Incorporating BEDT-TTF Repeat Units" *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **1995**, *36*(2), 292-293

Spangler, C.W.; Zhu, L.; Hall, T.J.; Balanda, P.B.; Reynolds, J.R. "Studies toward the Design and Synthesis of Superconducting Organic Polymers: Mainchain Incorporation of ET Subunits" *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **1995**, *36*(1), 605-606

Reynolds, J.R.; Katritzky, A.R.; Balanda, P.B.; Musgrave, R.; Soloducho, J.; Sotzing, G.A.; Sankaran, B.; Spangler, G.W.; Zhu, L. "Electrically Conductive and Redox Electroactive Organic Polymers" *Am. Chem. Soc., Proc. Div. Polym. Mats. Sci. Eng.* **1995**, *72*, .393-394

Balanda, P.B.; Child, A.D.; Reynolds, J.R. "Towards the Synthesis of Highly Functionalized Poly(*p*-phenylenes)" *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **1994**, *35*(1), 257-258

Cummings, D.C.; Mani, P.S.; Balanda, P.B.; Howell, B.A.; Mohanty, D.K. "Synthesis and Characterization of Poly(aryl ether-bissulfone)s *J. Macromol. Sci., Chem.* **1991**, *A28*(8), 793-810

Balanda, P.B.; Cummings, D.; Mohanty, D.K. "Synthesis and Characterization of Bisphenol-A, Hydroquinone and Biphenol Functional Poly(aryl ether) Bissulfones" *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)* **1990**, *31*(2), 671-672

OTHER PROFESSIONAL PARTICIPATION:

Attended American Chemical Society "44th National Organic Chemistry Symposium;" University of Maryland, College Park, Maryland; June 28-July 2, 2015.

Attended American Chemical Society "2014 Biennial Conference on Chemical Education;" Grand Valley State University; August 3&5, 2014, to attend *Symposia:*

"Engaging Students in Organic Chemistry: Lecture Methods Emphasis"
"Undergraduate Research in Chemistry: Expanding Opportunities and Broadening Participation"

Participated in the Ferris State University "Student Research Fellowship (SRF) Program," supervising the summer chemistry research efforts (10 weeks, full time) of two FSU Student Research Fellows, May-July, 2014

Attended "Integrating Contemplative Practices into the Teaching and Learning Experience," a retreat for FSU and GVSU faculty; Pierce Cedar Creek Institute; Hastings, Michigan; June 4-6, 2014

Attended "Liability & Safety Training for Academic Laboratories," session by The Office of Safety, Health, Environmental, & Risk Management in conjunction with the Academic Affairs Director of Laboratory Safety, Ferris State University, 1/29/2015.

Attended "Academic Laboratory Safety" sessions by Academic Affairs Director of Laboratory Safety, Anne Hawkins-Badge, Ferris State University, 8/21/2014 & 8/23/2013.

Participated in Workshops sponsored by Faculty Center for Teaching & Learning Workshops, Ferris State University:

"Tips for Flipping," 3/6/2014

"Whoever Does the Work Does the Learning: Facilitation Active Learning," 3/5/2014

"The Naked Presenter," FCTL Workshop, Ferris State University, May 22,23,30, June 4,6, & 19, 2013

"Presentation Zen," FCTL Workshop, Ferris State University, May 29,31, & June 5, 2013

"An Introduction to Learner-Centered Teaching," November 11, 2005

"Problem Based Learning," July 16-18, 2001

Attended "Essential Face-to-Face Blackboard Training Workshop," Ferris State University, 11/29/2011

Provided Consultation and Copolymerization Studies for Beholztech Inc., 132 West First Street, Flint, MI 48502. Synthesized a latex substrate for use as membrane in the manufacture of a bioanalytical device. Student research opportunity provided for Harry Roy (currently pursuing a Ph.D.) at Wayne State University; work was supported by Beholztech Inc. ($4000). May 2010-December 2011

Completed American Chemical Society short course: "Organic Synthesis: Methods and Strategies for the 21st Century Chemist", Boston, MA, May 20-22, 2009

Attended a two day NSF Multi-Initiative Dissemination Project Workshop, Central Michigan University, January 2003

Attended Ferris State University Spring Learning Institute – Teaching that Promotes Learning, 3/28/2003

Attended two symposia: "Self-assembled Photonic Band-gap Materials"; "Chromogenic Phenomena in Polymers: Tunable Optical Properties," 223rd ACS National Meeting, *Orlando, Florida,* April 7-11, 2002; Dean's Initiative Grant

Adsmond, D.; Balanda, P.B.; Frank, D. "FT-NMR Upgrade for a Collaborative Research-Based Organic Chemistry 2 Laboratory Course: Development and Implementation," NSF Proposal Number 0126961, *Awarded 2002*, Final Report, May, 2005

Attended "The 1st Annual Lilly Conference on College & University Teaching—North," September 21-22, 2001, Big Rapids, Michigan

Attended the NSCI Conference: "Instruction and Assessment: Infusing Brain Research, Learning Styles, and Multiple Intelligences," Phoenix, AZ; February 8-11, 2001

Attended Equity within the Classroom XI: Teaching and Learning in a Diverse Classroom; Big Rapids, MI; March 22-23, 2001

Attended Center for Teaching, Learning & Faculty Development's Facilitating Student Learning Program (2000-2001):

"Methods and Learners" (4 days)
"Repurposing Course Material" (4 days)
"Integrating Material into WebCT" (4 days)
"Student Assessment Techniques" (2 days)

Awarded Ferris State University Faculty Research Grant: "A New Route to Polyphenylenes: Self-Coupling of Arylboronates." 2000-2001

Attended "The 6th Annual Lilly Conference on College & University Teaching-South," Athens, Georgia; February 11-13, 2000

Awarded Ferris State University Professional Development Grant: "Development and Implementation of a Research Experience for Students in the Organic Chemistry Laboratory." Co-author: Daniel Adsmond.; 1999-2000

Awarded Ferris State University Professional Development Grant: "Project Oriented Curriculum for CHEM 211: Fundamentals of Organic and Polymer Chemistry,"1999-2000.

Attended Ferris State University Center for Teaching, Learning & Faculty Development workshops (1999-2000):

Case Studies Workshop
Get on the Web

Attended "1999 NSF Case Studies in Science Workshop," SUNY Buffalo (5 days)

Attended "Legal Issues for Educators Panel Discussion," Ferris State University, 1999

Attended "Grant Writing for New Faculty" workshop; Ferris State University, 1999

ACADEMIC SERVICE

Academic Senate, Ferris State University (2014-2015)

DAWG Days, Ferris State University (11/9/2013, 10/18/2014)

ACS Division of Chemical Education Examinations Institute, Committee Member for the 2012 Organic Chemistry Examination. Convening at the 241st (Anaheim, California, 3/26/2011-3/29/2011) and 242nd (Denver, Colorado, 8/27/2011-8/30/2012) American Chemical Society (ACS) National Meeting & Exposition

A Chemical Safety Committee (on behalf of the Hazardous Substance Awareness and Compliance Committee) to review a chemical hygiene plan for undergraduate research in the College of Pharmacy (2012-2013)

Interviewer for "Syria – US Ambassadorship Summer 2010," Ferris State University, June29-30, 2010

Academic Program Review Committee, Bachelor of Science in Nursing (2008-2009)

Academic Program Review Committee, Clinical Laboratory Sciences (1999-2000, 2004-2005)

Academic Senate Health Promotions and Substance Abuse Committee (2004-2007, secretary 2005-2006, 2006-2007)

Academic Senate Student Life Committee (2008-2010, chair 2009-2010)

Academic Senate Academic Standards and Policies Committee (2013-2015)

CAS Academic Policies and Standards Committee (2000-2003, 2006-2009, chair 2000-2003, 2007-2009)

CAS Curriculum Committee (2013-2015)

CAS Dean's Search Committee (2011-2012)

CAS Promotion and Merit (2009-2011)

CAS Sabbatical Review Committee (1999-2000)

CAS Graduate Education Committee (2013-2015)

Physical Sciences Department Chemistry Minor Committee (2009-2010)

Physical Sciences Department Tenure Review Committee (2003-2014, chair 2006-2014)

Physical Sciences Department Tenure Policy Revision (2012-2013, chair 2012-2013)

Physical Sciences Department Candidate Tenure Committee (2006-2007, 2010-2011)

Physical Sciences Department Planning Committee (2007-2008, 2010-2012)

Physical Sciences Department Equipment Committee (2006-2013)

Physical Science Department Faculty Development and Travel Committee (1999-2001, 2004-2005, chair 1999-2000)

Physical Sciences Department Curriculum Committee (2000-2002, 2005-2007, 2008-2009, 2012-2015)

Physical Sciences Department Head Evaluation Committee (2000-2001)

Physical Sciences Department Safety Committee (1998-2002, chair 1999-2002)

Physical Science Department Faculty Search Committee (2004-2005)

Faculty advisor to the Sigma Pi men's fraternity (1999-2002)

Reitz Reading Room Committee (1998-1999)

COMMUNITY SERVICE & AWARDS

Service to Mecosta-Osceola Intermediate School District (MOISD)

Math, Science and Technology Center (MSTC) Science & Engineering Fair
Project Involvement: Mentor for Chloe Balanda (2007-2008), mentor for Alina Lou (2004-2005), assistance to: Phil Videtich (2004-2005)
Science Fair Judge (2006-2007, 2009-2012)

"Atoms, the Periodic Table, and Reactivity" Presentation to the 5th grade at Crossroads Charter Academy, November, 2007

Polymer chemistry laboratory/workshop provided for MSTC students, spring 2000

"The Structure and Functional Roles of Fats" Presentation to the Lions Club, January, 2003

Mecosta County Medical Center Foundation, Outdoor Activities and Sports Committee, Northern Lights Award Show 2008

Youth Soccer Volunteer (1999-2012)
American Youth Soccer Organization, Coach (1999-2002)
United States Youth Soccer Association (2002-2012):
Founding member: Northland United Soccer Club: Coach (2002-2011);
Director of Youth Development (2003–2009); President (2005-2011); Recreation Program Referee Assigner (2007-2012)
Nominee: Michigan State Youth Soccer Association 2003 Volunteer of the Year
Recipient: Mecosta County Medical Center Foundation, 2007 Northern Lights Award for Outdoor Activities and Sports

Finalist: Pioneer Group's 2009 Mecosta County Citizen of the Year
Recognition: Bench dedication at Industrial Park Soccer Field, 2012
Earned: United States Soccer Federation National Youth License, 2010

Knights of Columbus: Member (2000-present), Recorder (2003-2010), Trustee (2010-13, 2014-present), Chancellor (2013-2014); Charity Golf Tournament Chair (2007-2013); Breakfast Crew Leader (2009-present); Lifetime Achievement Award (2014)

Francis Marion Burns, Ph. D.

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Skype: francis.burn7

Home Address:
217 Woodward Avenue
Big Rapids, Michigan USA 49307
01-231-408-8615 (mobile)

PROFESSIONAL EXPERIENCE

2005-2011, 2012-present Visiting Assistant Professor of Chemistry, Ferris State University
Teach general chemistry: one semester and two-semester courses. Supervise "peer-leader" discussion sections for general chemistry. Teach freshman seminar (Honors 100). Engage in chemical education research, student assessment activities, and undergraduate research. Additional responsibilities include participating in university committees, and serving as the departmental Webmaster.

2011 - 2012 Lecturer, Koya University, Kurdistan, Iraq
Taught analytical and instrumental chemistry in English to Kurdish students. Supervised undergraduate analytical chemistry research projects. Additional responsibilities included technical support for chemical instrumentation.

Summer 2010 Advanced Placement (AP) Reader, College Board, Princeton, New Jersey
Served as a reader for free response questions on the 2010 AP Chemistry exam.

2008 - 2009 Quality Control Analyst, Perrigo Company, Allegan, Michigan
Performed a variety of analytical tests on over-the-counter drugs, using Food and Drug Administration (FDA) approved procedures.

2006 - 2008 Consultant, Media Development Group, College Division, Houghton-Mifflin Company, Boston, Massachusetts
Provided editorial review of online and printed content associated with chemistry textbooks, including General, Organic, and Biological Chemistry, 4th Edition (Stoker) and General Chemistry, 8th Edition – Media Enhanced (Ebbing).

1999 - 2005 Assistant Professor of Chemistry, Grand Valley State University
Taught a range of analytical courses, including instrumental analysis. Collaborated in a team-taught Honors course: *the Human Body in Motion*. Additional responsibilities included advising students, participating in university committees and governance, engaging in scholarship activities, and participating in community outreach activities.

1995 - 1999 Graduate Student, College of Arts and Sciences, The University of Toledo
Taught laboratory for the junior physical chemistry, senior instrumental analysis, and the graduate spectroscopy and separation courses. Additional responsibilities included the maintenance and troubleshooting of the instrumentation. Provided technical support for educational software and departmental web page.

Summer 1994 Environmental Chemist, OHM Corporation, Findlay, Ohio
Performed environmental analyses according to EPA protocols using a variety of analytical methods, including titrimetry, gravimetry, and ion chromatography.

1991 - 1995 Assistant Professor of Chemistry, University of Findlay, Findlay, Ohio
Taught liberal arts, general chemistry, and organic chemistry lab. Developed a general chemistry laboratory curriculum for science majors. Coordinated the non-instructional aspects of the chemistry laboratories.

1989 - 1991 Undergraduate Chemistry Laboratory Coordinator, The University of Houston
Coordinated the non-instructional aspects of the freshman and organic chemistry laboratory courses. Provided supervision and technical support to teaching assistants.

1988 - 1989 Science Education Graduate Student, The Ohio State University
Taught general biology as a biology-teaching assistant. Investigated the stress and turnover of state directors for the USDA agriculture extension service as an agriculture education research student.

1986 - 1988 Research Assistant, College of Medicine, The Ohio State University
Collected data for Phase III clinical cancer trials. Resolved questions concerning protocols for the treating physicians and questions regarding study participants for the primary investigators.

EDUCATION

Ph.D. in Analytical Chemistry. 1999. The University of Toledo, Toledo, Ohio
Advisors: Dr. Jon. R. Kirchhoff and Dr. Dean M. Giolando
Dissertation: "Fabrication and Characterization of Electrochemical Sensors"

M.A. in Science Education. 1991. The Ohio State University, Columbus, Ohio
Specialization in Chemical Education.
Ohio Teaching Certification for Chemistry and Biology
Michigan Teaching Certification for Chemistry and Biology

B.S. in Entomology. 1986. The Ohio State University, Columbus, Ohio
Engaged in undergraduate research projects involving mosquitoes, honey bees, or aphids

PUBLICATIONS

1. "Characterization of Ceramic-based Dual Ultramicroelectrodes by Microscopic and Electrochemical Methods." F. M. Burns, D. M. Giolando, J. R. Kirchhoff. *Proceedings: Microscopy and Microanalysis* **1997**, *3(Supplement 2)*, 1245-1246.

2. "The use of electronic media for chemical education research." F. M. Burns & D. Frank. *Chemistry Education and Sustainability in the Global Age* **2013**, 185-195.

PRESENTATIONS

1. "The Economics of Laboratory Safety." Francis M. Burns, 209th National Meeting of the American Chemical Society, Anaheim, California, April 1995. (Invited presentation, Symposium on Safety Issues of Small Colleges)

2. "Fabrication of Modified Dual Ultramicroelectrodes for Trace Analysis." Francis M. Burns, Dean M. Giolando, Jon R. Kirchhoff, 28th Central Regional Meeting of the American Chemical Society, Dayton, Ohio, June 1996. (Poster presentation)

3. "Fabrication of Ceramic-based Dual Ultramicroelectrodes by Chemical Vapor Deposition." Francis M. Burns, Jon R. Kirchhoff, Dean M. Giolando, 1997 Pittsburgh Conference and Exposition, Atlanta, Georgia, March 1997. (Contributed presentation)

4. "Fabrication and Characterization of Ceramic-based Dual Ultramicroelectrodes." Francis M. Burns, Jon R. Kirchhoff, Dean M. Giolando, Sigma Xi Graduate Symposium, Toledo, Ohio, May 1997. (Contributed presentation)

5. "Characterization of Ceramic-based Dual Ultramicroelectrodes by Microscopic and Electrochemical Methods." Francis M. Burns, Dean M. Giolando, Jon R. Kirchhoff, Microscopy and Microanalysis 97, Cleveland, Ohio, August 1997. (Poster presentation)

6. Dual Ultramicroelectrodes Devices for Electroanalysis." Jon R. Kirchhoff, Francis M. Burns, Dean M. Giolando, 24th Annual Conference of the Federation of Analytical and Spectroscopy Societies, Providence, Rhode Island, October 1997. (Invited presentation, Symposium on Electrochemical Detectors and Sensors)

7. "Investigation of Silicon Carbide as an Electrode Material for Electroanalysis." Jon R. Kirchhoff, Phy Qui Nguyen, Frank Meier, Francis M. Burns, Julie M. Mosher, Dean M. Giolando, 1998 Pittsburgh Conference and Exposition, New Orleans, Lousiana, March 1998. (Contributed presentation)

8. "Development of Microsensors Based on the Ring-Disk Ultramicroelectrode." Francis M. Burns, Dean M. Giolando, Jon R. Kirchhoff, 1998 Pittsburgh Conference and Exposition, New Orleans, Lousiana, March 1998. (Contributed Presentation)

9. "Fabrication and Characterization of Alumina-Coated Tungsten Wire Ultramicroelectrodes by Chemical Vapor Deposition." Ihab N. Odeh, Francis M. Burns, Dean M. Giolando, and Jon R. Kirchhoff, 30th Central Regional Meeting of the American Chemical Society, Cleveland, Ohio, May 1998. (Contributed presentation, Undergraduate Research Symposium)

10. "Evaluation of a Web-based Chemistry Assignment Using a Course Portfolio" by Francis M Burns, 16th Biennial Conference on Chemical Education, Ann Arbor, Michigan, August 2000. (Contributed presentation)

11. "The Human Body in Motion: Biology, Chemistry, and Physics at Work and Play" Francis Burns, Brad Ambrose, and Jim Scott, 17th Biennial Conference for Chemical Education, Bellingham, Washington, August 2002. (Contributed presentation)

12. "Career Opportunities in Food Science" Francis M Burns, Student Affiliate Chapter of the American Chemical Society, Ferris State University, Big Rapids, March 2000. (Invited presentation)

13. "Gazing into the Future with a Fogged Crystal Ball" Francis M Burns, 232nd National Meeting, American Chemical Society, San Francisco, California, September 2006. (Contributed presentation)

14. "Open Educational Resources in Chemistry – Empowering the People" Francis Burns, 41st World Chemistry Congress, Turin, Italy, August 2007. (Contributed presentation)

15. "The effect of online learning logs on student outcomes in general chemistry" Francis Burns, Dave Frank, Tracy Kerr, and Todd Stanislav, 20th Biennial Conference for Chemical Education, Bloomington, Indiana, August 2008. (Contributed presentation)

16. "The Use of Electronic Media for Chemical Education Research" Francis Burns and Dave Frank, 21st International Conference for Chemical Education, Taipei, Taiwan, August 2010. (Contributed presentation)

17. "The Use of Electronic Media for Chemical Education Research" Francis Burns, Koya University, Kurdistan, Iraq, May 2011. (Invited presentation)

18. "Mercury Analysis" Francis Burns, Koya University, Kurdistan, Iraq, April 2012. (Invited presentation)

19. "The Use of Electronic Media for Classroom Assessment: Looking at Learning Through Students' Eyes" Francis Burns, Faculty Center for Teaching and Learning, Ferris State University, Big Rapids, November 2013. (Invited presentation)

20. "The Use of Electronic Media for Classroom Assessment: Looking at Learning Through Students' Eyes" Francis Burns, The 5th Annual Scholarship of Teaching & Learning Academy, Grand Valley State University, Grand Rapids, Michigan, May 2013. (Contributed presentation)

21. "Chemical Stories: Better Chemistry through Creative Writing," Francis Burns and David Frank, 23rd IUPAC International Conference on Chemical Education, Toronto, Canada, July 2014. (Contributed presentation)

WORKSHOPS & PROFESSIONAL DEVELOPMENT

1. "Laboratory Safety" Workshop, Curry College, July 1991 (participant)

2. "Leadership Conference" Committee on Local Section Activities, American Chemical Society, Salt Lake City, Utah, February 2003 (participant)

3. "Advanced Leadership Conference" Committee on Local Section Activities, American Chemical Society, Saint Louis, Missouri, May 2003 (participant)

4. "Qualitative Educational Research: Design and Implementation" 20th Biennial Conference for Chemical Education, Bloomington, Indiana, August 2008. (Participant)

5. "Online Student Journaling Through the Use of Discussion Boards" Faculty Center for Teaching and Learning - Spring Learning Conference, Ferris State University, Big Rapids, February 2008. (Organized)

6. "Democritus to Dalton and Beyond" Faculty Center for Teaching and Learning – Faculty Discussion Group, Ferris State University, Big Rapids, Spring 2009. (Organized)

7. "Science at the Crossroads" Francis Burns, Faculty Center for Teaching and Learning – Faculty/Staff Discussion Group, Ferris State University, Big Rapids, Fall 2009. (Organized)

8. "International Visiting Scholar (Dr. Liliana Mammino)," Faculty Center for Teaching and Learning, Office of International Education, College of Arts & Sciences, and Physical Sciences Department, Ferris State University, Big Rapids, Spring 2011. (Organized)

9. "Certificate for Online Adjunct Teaching (COAT) Course," Frederick Community College and MarylandOnline.org, May, 2013. (participant)

10. "Self-Compassion and Emotional Resilience (Dr. Kristin Neff)" workshop, Faculty Center for Teaching and Learning, Spring 2014. (Participant)

11. "FSU Freshman Training Workshop," College of Retention & Student Success, Summer 2014. (Participant)

GRANTS

1. Research Grant, Graduate Student Association, University of Toledo, 1995 and 1998

2. Travel Grant, Academic Careers in Chemistry Workshop, Camille and Henry Drefus Foundation, 1998

3. Travel Grant, 1998 Pittsburgh Conference and Exposition, Society for Electroanalytical Chemistry, 1998

4. Travel grant, 8th AAHE Conference on Faculty Roles and Rewards, Pew Faculty Teaching and Learning Center, Grand Valley State University

5. Faculty Research Grant, "Purification and Characterization of Environmental Organochromium Compounds," Research and Development Committee, Grand Valley State University, 2000

6. Faculty Summer Research Stipend, "Purification and Characterization of Environmental Organochromium Compounds," Research and Development Committee, Grand Valley State University, 2000

7. Summer Undergraduate Research Program, "Separation and Detection of Organochromium Compounds in Environmental Samples" by Steve Bremmer and Francis Burns, Division of Mathematics and Science, Grand Valley State University, 2000

8. Pew Faculty Teaching and Learning Center Presidential Teaching Initiative Grant, "A Proposal for an Integrated Science Sequence" by Johnine Callahan, Bradley Ambrose, Francis Burns, Brian Curry, and Stephanie Schaertel, Pew Faculty Teaching and Learning Center, Grand Valley State University, 2000

9. Travel Grant, 7th Annual National Conference on Undergraduate Research, Research and Development Committee, Grand Valley State University, 2000

10. Travel Grant, 16th Biennial Conference on Chemical Education, Research and Development Committee, Grand Valley State University, 2000

11. Travel Grant, 17th Biennial Conference on Chemical Education, Research and Development Committee, Grand Valley State University, 2000

12. Teaching Circle Grant, Pew Faculty Teaching and Learning Center, Grand Valley State University, 2003

13. Campbell Foundation grant (not funded), "Trace Elements - The Neglected Antiepileptics" C. E. Pipenger (P. I.), Francis Burns, Linda Goossen, 2003

14. Timme Travel Grant, 20th Biennial Conference on Chemical Education, Faculty Center for Teaching and Learning, Ferris State University, 2008

15. Timme Travel Grant, 21st International Conference for Chemical Education, Faculty Center for Teaching and Learning, Ferris State University, 2010

16. "Student Assistant Grant," Faculty Center for Teaching and Learning, Ferris State University, 2014

PROFESSIONAL AFFILIATIONS

American Chemical Society (ACS),

- Division of Chemical Education
- Western Michigan Local Section

International Union of Pure and Applied Chemistry

HONORS

National Merit Semifinalist, Educational Testing Service, 1980
Varsity Athlete, The Ohio State University, 1982 to 1986
Scholar-Athlete, The Ohio State University, 1982 to 1986
Staff Excellence Award, University of Houston, 1990
CARI Fellowship, Department of Chemistry, The University of Toledo, 1995 and 1998
Graduate Fellow, Instrumentation Center, College of Arts and Sciences, The University of Toledo, 1998

UNIVERSITY SERVICE

Newman Club faculty advisor, The University of Findlay, 1992-1995
University Research Council member, The University of Toledo, 1995-1996
Grand Valley State University:
- Honors Science Curriculum Committee member, 1999-2000
- Honors Program Advisory Committee member, 2000-2002
- Academic Resource Center Advisory Committee, 2001-2003
- Chemical Education Faculty Search Committee, 2001-2002
- Chair of a divisional working group charged with designing a lecture-laboratory facility for Honors science and in-service science teacher workshops, 2001-2002
- Faculty Advisor for the Honors College Student Council, 2002-2003
- Academic Resource Center Advisory Council member, 2000-2002
- Departmental Personnel and Assessment Committees member, 2003-2004

Ferris State University:
- Laboratory Safety Committee member, 2005-2006
- Faculty Development Committee member, 2006-2007
- Departmental Webmaster, 2007-2011, 2013 – present

COMMUNITY SERVICE

Science Olympiad supervisor, The University of Findlay, 1992
Einstein Day contributor, Gesu Elementary School, 1996 and 1997
Cross-country coach, Gesu Elementary School, 1995, 1997, and 1998
West Michigan Clean Air Coalition member, 1999 to 2002
Science Olympiad supervisor, Grand Valley State University, 2000-2004
West Michigan Science Festival event sponsor, Grand Valley State University, 2000
Science Odyssey Event Supervisor, Grand Valley State University, Allendale, MI, 2001
Soccer coach, Walker Recreation Program, Walker, Michigan, 2001
Career Day participant, West Catholic High School, 2002
Science Fair judge, Mecosta County Independent School District, 2008
Officer, Western Michigan Local Section of the American Chemical Society
- Chemistry in the Mall co-coordinator, 2003
- Chair, 2003-2005
- Counselor, 2005-2007
- 2015 Central Regional Meeting treasurer, 2013-present

Reviewer, ARO Journal (publication of Koya University, Kurdistan, Iraq)

PRIOR CHEMISTRY COURSES (as an instructor)

1. Liberal Arts Chemistry ("Chemistry and Society")
2. Introductory General Chemistry for Allied Medicine and Nurses
3. General Chemistry I & II (Science, Pre-professional, & Pre-engineering)
4. Organic Chemistry (Laboratory only)
5. Quantitative Analysis (Chemistry Majors)
6. Instrumental Analysis (Chemistry Majors)
7. Combined Quantitative/Instrumental Analysis (Chemistry Minors)
8. Physical Chemistry (Laboratory only)
9. Graduate Spectroscopy & Separation courses (Laboratory only)

PRIOR NON-CHEMISTRY COURSES (as an instructor)

1. Honors Science ("Human Body at Work & Play")
2. Freshman Seminar ("Honors 100")

REFERENCES

David Frank, Ph.D.
Department Head
Physical Sciences Department
Ferris State University
Big Rapids, Michigan 49307-2225
01-231-591-2580 (office)
01-231-591-2545 (fax)
frankd@ferris.edu

Todd Stanislav, Ph.D.
Director
Faculty Center for Teaching and Learning
Ferris State University
Big Rapids, MI 49307
01-231-591-3541 (office)
stanist@ferris.edu

Arlene Krellwitz (Retired)
Coordinator
Structured Learning Assistance Program
College of Retention & Student Success, Ferris State University
Home address:
17122 Outer Drive
Big Rapids, Michigan 49307
01- 231-796-1231 (home)
arlenek47@hotmail.com

Gaylany H Abdullah, Ph.D.
Hawler Medical University
Hawler, Kurdistan – Iraq
00964-750-308-2923 (Mobile)
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CURRICULUM VITA

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Department of Physical Sciences
Ferris State University
Big Rapids, Michigan 49307
(231) 591-5851 colvertk@ferris.edu

CURRENT TEACHING RESPONSIBILITIES

Survey, introductory and advanced courses in biochemistry and biochemistry labs, proteins laboratory.

Courses Taught at Ferris:

Quantitative Analysis (CHM 231)
Introductory Biochemistry (CHM 324)
Biochemistry (CHM 364)
Instrumental Analysis (CHM 231)
Chemical Calculations (ICT 221)
Biochemistry Lab I (CHM 332)
Biochemistry Lab II (CHM 333)
Organic/Biochemistry (CHM 124)
Inorganic Chemistry (CHM 114)
Introductory Chemistry (CHM 100)
Proteins Laboratory (BIOL 473)
Advanced Topics in Biochemistry (CHEM 474)
Chemistry and Food (CHEM 104)
Intro to Physical Chemistry (CHEM 451)

CURRENT RESEARCH INTERESTS

Binding site interactions and mechanisms of ATP synthases;, ATP synthesis assay development, neurotransmitter detection by enzyme-coated microprobes.

POST DOCTORAL RESEARCH

In vitro metabolism and macromolecular binding of suspected carcinogens using HPLC, radioisotope, and protein and DNA isolation techniques. Suicide inactivation of cytochromes P450, affinity chromatography.

GRADUATE RESEARCH

Interaction between proteins in the electron transport chain of photosynthesis using protein purification and analysis techniques, enzyme assays, covalent crosslinking and absorbance spectroscopy.

EDUCATION

PhD August, 1984, University of Arkansas, Fayetteville, Arkansas 72701. Major: Biochemistry. Dissertation Title: "Interaction of Ferredoxin with Ferredoxin:NADP Reductase in Chloroplast Membranes." Advisor: Dr. Danny J. Davis

B.A. June, 1977, Hendrix College, Conway, Arkansas 72032. Major: Chemistry.

PROFESSIONAL EXPERIENCE

September, 1988 to present
Asst./Assoc./Full Professor of Chemistry, Physical Sciences Department
Ferris State University. Big Rapids, MI

August, 1986 to August, 1988
Assistant Professor of Chemistry
Chemistry Department
Southwest Missouri State University , Springfield, MO

August, 1984 to August, 1986
Postdoctoral position with Peter P. Fu,
Division of Biochemical Toxicology, National Center for Toxicological Research, Jefferson, AR. (Exchange Program with Veteran's Administration, Little Rock, AR)

ACTIVITIES AND AWARDS

Academic Scholar Award, Academic Affairs, 2012
Sabbatical Leave, University of Kansas-Lawrence, August 2009-August 2010
Sabbatical Leave, University of Kansas-Lawrence, August 2001-August 2002
(American Heart Association Grant)
Sabbatical Leave, University of Kansas-Lawrence, August 1994-June 1995
Ferris Faculty Research Grant, June 1993-May 1994
NSF Research Opportunity Award, University of Kansas-Lawrence. June-August 1990 and June-August 1991
Chair, Western Michigan Section, American Chemical Society. 1991
Faculty Research Grant, Southwest Missouri State University. June 1987-June 1988.

COMMITTEES (current)

Departmental: Tenure Review, Candidate Tenure Committees, Equipment, Scholarship, Search, Departmental Faculty Development

University: Biotechnology Advisory

Additional Service:
B.A. Biochemisty Program Coordinator
RSO advisor for Biotechnology Student organization
Independent Study Mentor (16 students since 2011)
Math /Science Student Project mentor (2 since 2005)
Science Fair
Dawg Days Volunteer
Alumni Outreach, Homecoming 2014

PUBLICATIONS

Stephanie C. Bishop, Shyam Mehta, Kim K. Colvert, Daxin Zheng, Mark L. Richter, Cindy L. Berrie and Fei Gao. "Insertion of a Rigid Structural Element into the Regulatory Domain of the Chloroplast F1- ATPase Gamma Subunit for Rotational Studies." *(to be published in the proceedings of 15th International Congress on Photosynthesis which was held on 22-27 August 2010, in Beijing, China)*

Kim K. Colvert, Fei Gao, Daxin Zheng, Shyam Mehta, Mark L. Richter, The Mutation E242K in the chloroplast ATP synthase Gamma Subunit Increases the Inhibitory Binding of the Epsilon Subunit Without Changing the Apparent Redox Potential of the Regulatory Dithiol." *(to be published in the proceedings of 15th International Congress on Photosynthesis which was held on 22-27 August 2010, in Beijing, China)*

Quillen, E.E., Haslam, G.C., Samra, H. S., Amani-Taleshi, D., Knight,J.A., Wyatt, D.E., . Bishop, S.C., Colvert, K.K, Richter M.L., Kitos, P.A. "Ectoadenylate kinase and plasma membrane ATP synthase activities of human vascular endothelial cells." J. Biol. Chem., vol. 281, 20728-20737, 2006

Kirch, R.D., Colvert, K.K., Richter, M. L., Graber, P., "Intrinsic Fluoresence of the Chloroplast H^+-ATPase.", Archives of Biochemistry and Biophysics, vol. 316, 1995.

K.K. Colvert, D.A. Mills, and M. L. Richter, "Structural Mapping of Cysteine 63 of the Chloroplast ATP Synthase Beta Subunit", Biochemistry, vol.31, pp. 3930-3935, 1992

L.Z.Morand, M.K. Frame, K.K. Colvert, D.A. Johnson, D.W. Krogmann, and D.J. Davis, "Plastocyanin Cytochrome $_f$ Interaction," Biochemistry, vol. 28, pp. 8039-8047, 1989.

K. K. Colvert and D. J. Davis, "Characterization of a covalently crosslinked complex involving ferredoxin and ferredoxin:NADP reductase," Photosynthesis Research, vol. 17, pp. 231-245, 1988.

K. K. Colvert, M. W. Chou, and P.P. Fu, "*In Vitro* Binding of Nitro-Polycyclic Aromatic Hydrocarbons and Their Oxidative Metabolites to Macromolecules," presented at the International Symposium on Polynuclear Aromatic Hydrocarbons, National Bureau of Standards, Gaithersburg, Maryland, September, 1987 (published in the proceedings of this meeting).

Kim K. Colvert and Peter P. Fu, "Xanthine Oxidase-Catalyzed DNA Binding of Dihydrodiol Derivatives of Nitro-Polycyclic Aromatic Hydrocarbons," Biochemical and Biophysical Research Communications, vol. 141, pp. 245-250, 1986.

Barbara J. Vieira, Kim K. Colvert, and Danny J. Davis, "Chemical Modification and Cross-linking as Probes of Regions on Ferredoxin Involved in its Interaction with Ferredoxin:NADP Reductase, "Biochemica et Biophysica Acta, vol. 852, pp. 109-122, 1986.

Kim K. Colvert and Danny J. Davis, "Effect of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," Archives of Biochemistry and Biophysics, vol. 225, pp. 936-943, 1983.

PRESENTATIONS

Effects of Putrescine Oxidase Active Site Mutations on Activity. Lukas Woodcock , Dr. Kim Colvert, American Chemical Society National Meeting, Student poster session, March 2015; Ferris State University CAS Student Awards Ceremony and Poster Session, April 2015.

Chemical Rescue of a Mutant Beta-Glycosidase from *Sulfolobus Solfataricus* by Indole and Indole Derivatives. Doug Hulbert, Elizabeth Utke,Matthew Mousseau, Dr. Kim Colvert, Ferris State University
CAS Student Awards Ceremony and Poster Session, April 2015

The Role of His 432 Putrescine Oxidase in Substrate Interaction. Lukas Woodcock , Dr. Kim Colvert, Ferris State University CAS Student Awards Ceremony and Poster Session, April 2014; Midwestern Symposium on Undergraduate Research in Chemistry, Michigan State University, Oct. 2014

Kinetic Characterization of Mutant Beta-Glycosidase from *Sulfolobus Solfataricus Chemically Rescued by Indole*. Jacob Hare, Matthew Mousseau, Dr. Kim Colvert, Ferris State University CAS Student Awards Ceremony and Poster Session, April 2014

His Tag Removal and Heme Incorporation of Recombinant CCP1. Lukas Woodcock, Matthew Manninen, Dr. Kim Colvert, Ferris State University CAS Student Awards Ceremony and Poster Session, April 2013; Midwestern Symposium on Undergraduate Research in Chemistry, Michigan State University, Oct. 2013

Temperature Effects on Activity and Flavin Content of Recombinant L-6-hydroxynicotine Oxidase and Mutants. Thomas Dingman, Kimberly Johnson, Dr.Kim Colvert Ferris State University CAS Student Awards Ceremony and Poster Session, April 2013;

Midwestern Symposium on Undergraduate Research in Chemistry, Michigan State University, Oct. 2013

“Kinetic characterization of recombinant nicotine oxidase (6-L-hydroxy nicotine oxidase) from *Arthrobacter oxidans*. Nga Ton nu, Dr. Kim K. Colvert , Ferris State University CAS Student Awards Ceremony and Poster Session, April, 2012

The kinetics of recombinant 6-L-hydroxy nicotine oxidase are altered in the chimera of 6-L-hydroxy nicotine oxidase and maltose binding protein. David Kallio, Nga Tan nu, Dr. Kim Colvert Ferris State University CAS Student Awards Ceremony and Poster Session, April, 2012

Isolation and Characterization of Recombinant *Saccharomyces cerevisiae Cytochrome C Peroxidase.*
Matthew Manninen , Dr. Kim K. Colvert, Ferris State University CAS Student Awards Ceremony and Poster Session, April, 2012

Colvert, K. K. (Dec. 2011) “What I Do On My Summer Vacations: Current Research”, Ferris Student Affiliate Chapter of the American Chemical Society.

Knight, J., Colvert, K.K., Amani, D., Haslam, G., Samra, H., Kitos, P.A. and Richter, M.L. (2003) "A novel plasma membrane ATP synthesis activity in human umbilical vein endothelial cells" KU undergraduate research symposium

Kim K. Colvert, "Structural Mapping of Cysteine 63 of the Chloroplast ATP Synthase Beta Subunit" Physical Sciences Department, Ferris State University, Big Rapids, Michigan, March, 1993

Gao, F., Colvert, K.K. & Richter, M.L. (1992) *Permanent asymmetry in the chloroplast ATP synthase: evidence against a rotational mechanism,* Midwest Biochemistry Conference, Manhatten Kansas

Mills, D.A., Colvert, K.K., & Richter, M.L. (1990) *Identification and distance mapping of the ATP binding site on the b subunit of the chloroplast ATP synthase,* Midwest Biochemistry Conference, University of Oklahoma

Mills, D.A., Colvert, K.K., & Richter, M.L. (1990) *Structural mapping of the b subunit of the chloroplast ATP synthase,* Gordon Research Conference, Bioenergetics, Vermont

Kim K. Colvert, "Metabolism of Benzo(a)pyrene by Plant Microsomal Enzymes," Midwest Regional Meeting, American Chemical Society, Wichita, Kansas, November, 1987.

K.K. Colvert, N.W. Chou, and P.P. Fu, "*In Vitro* Binding of Nitro-Polycyclic Aromatic Hydrocarbons and Their Oxidative Metabolites to Macromolecules,"

International Symposium on Polynuclear Aromatic Hydrocarbons, National Bureau of Standards, Gaithersburg, Maryland, September, 1987

Kim K. Colvert and Peter P. Fu, "Reductive Metabolism of Nitrated Polycyclic Aromatic Hydrocarbons to DNA Binding Derivatives," 190th National Meeting of the American Chemical Society, Division of Biological Chemistry, Chicago, Illinois, September 1985.

Kim Colvert and Danny J. Davis, "Preparation and Characterization of a Covalently Linked Adduct Between Ferredoxin and Ferredoxin:NADP Reductase," Ann. Plant Biochemistry-Physiology Symposium, University of Missouri-Columbia, Missouri, April, 1984.

Kim Colvert, Keith Hough, and Danny J. Davis, "Covalent Linkage of Interacting Proteins of the Photosynthetic Electron Transport Chain by a Water-Soluble Carbodiimide," Southwest Regional Meeting, American Chemical Society, Tulsa, Oklahoma, December, 1983.

K. Colvert and D. J. Davis, "Effects of pH and Salt on Km for Ferredoxin in NADP Photoreduction by Chloroplast Membranes," Ann. Plant Biochemistry-Physiology Symposium, University of Missouri-Columbia, Missouri, April, 1982.

D.J. Davis and K. Colvert, "Effects of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," Midwest Photosynthesis Conference, Argonne National Laboratory, Argonne, Illinois, October, 1982.

K. Colvert and D.J. Davis, "Effects of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," West Central States Biochemistry Conference, Stillwater, Oklahoma, November, 1982.

Curriculum Vitae
William Killian
Department of Physical Sciences
Ferris State University
231-349-1578
WilliamKillian@ferris.edu

Education:

North Park Colleges, B.A. Biology, 1973. Magna Cum Lauda Graduate.

Ohio State University, M.S. Chemistry, 1976.
Area of Research: Synthesis and Characterization of Substituted. Dihydropyridines in Relation to NAD/ NADH models.

Representative Summer Experience

Summer 1998&1999: Taught at Parke-Davis and coordinated pharmaceutical chemical tech certificate program

Summer 1994: Visiting Scientist, Dow Chemical Company, Surfactant Research

Summer 1992&1993: Research Associate, The Upjohn Company, HPLC method development.

Full Time:

1987-Present: Associate Professor, Industrial Chemical Coordinator, Ferris State University

Courses Taught:

- General Chemistry
- Laboratory Safety
- Applied Analytical Chemistry
- Instrumental Analysis

1985-1986: Instructor, George Williams college.
Closed in March '86 due to financial exigency.

1984-1985: Instructor, Loop Junior College, part-time position.
Courses Taught:

- General Chemistry
- Environmental Science

1981-1985: Chemistry/Manager, Inland Steel.
2 years as an EPA compliance water/waste water chemist.
2 years as a quality control manager for chemical operations at rolling mill.

Publications/Presentations:

"N-ACYL-1, 4-Dihydroprydines by Acid Catalyzed Condensations," Tetrahedron Letters, 16, 1407-1410, 1978

"Development of a Process for Treating Red Water by Organic/ Inorganic Separation and Biodegradation," 14th Annual Army Environmental R&D Symposium, Williamsburg, VA, November 14-16, 1989.

"Detection of Chemical Plumes Utilizing Passive-Remote Fourice Transform FTIR Spectroscopy," 44th Annual Pittsburgh Conference and Exposition on Analytical Chemistry, Atlanta, GA, March 8-12, 1993.

"The Role of an Industrial Advisory Board in Chemical Technology Program,"
15th Biennial Conference on Chemical Education, Waterloo, Ontario, August 1998.

"How to Obtain Accreditation for a Two-Year Industrial Technology Program," ACS Region Meeting, Midland, MI, October, 1997.

"A Mechanistic Representation For the Synthesis of Benzanthrone and Violanthrone,"Journal of Polycyclic Aromatic Compounds, Vol 19, pp 179-197, 2000.

"Roundtable Discussion of Curricular Issue in Chemical Technology Programs,"
BCCE in Lafayette, IN, 2006.

ICT Chemistry poster and presented at National ACS Meeting, 2013.

Affiliations:

American Chemical Society
Instrumental Society of America

YAMUNA KOLLALPITIYA

830 Woodward Ave · Big Rapids, MI 49307
(316) 734-0348 · yamunakollalpitiya@yahoo.com

EDUCATION

Wichita State University, Wichita, KS
Ph.D. in Chemistry/Biochemistry *July 2011*
Dissertation
Part I**:** Investigation of Mechanisms of Copper and Zinc Neurotoxicity
Part II: Pre-steady State Kinetics of the Reduction of Cytochrome b_{561} with Ascorbate

M.Sc. in Chemistry/Biochemistry *May 2008*
Relevant coursework
Electroanalytical Chemistry, Photochemistry, Spectroscopy, Physical Biochemistry, Analytical Spectroscopy, Bioorganic Chemistry, Advanced Biochemistry, Neurochemistry

University of Colombo, Sri Lanka
M.Sc. in Analytical Chemistry *August 2004*
(Completed theory and practical components only)

University of Peradeniya, Sri Lanka
B.Sc. in Chemistry, 2nd class upper division *March 2000*
Subsidiary Subject: Physics

TEACHING EXPERIENCE

Assistant Professor *August 2013 - Present*
Department of Physical Sciences, Ferris State University, Big Rapids, MI

- Taught biochemistry courses (CHEM 324 and OPTM 530)
- Instructed General Chemistry Labs (CHEM 114, 122 and 103)

Professor *July 2011 – May 2013*
Department of Chemistry, Warren Wilson College, Asheville, NC

- Created syllabi and taught Principles of Chemistry, General Chemistry and Biochemistry courses
- Instructed Biochemistry and Analytical Chemistry lab sessions
- Served as a student advisor and a research mentor

Teaching Assistant *August 2006 – May 2011*
Department of Chemistry, Wichita State University, Wichita, KS

- Instructed labs and recitation sessions for General Chemistry and Biochemistry
- Individually mentored three undergraduate students in independent research projects

Temporary Lecturer *May 2000 – September 2000*
Department of Chemistry, University of Peradeniya, Sri Lanka

- Conducted lab sessions and group discussions in undergraduate Organic Chemistry, Inorganic Chemistry, and Physical Chemistry lecture classes

TEACHING INTERESTS

Biochemistry, General Chemistry, Analytical Chemistry, Physical Chemistry

RESEARCH EXPERIENCE

Ph.D. Candidate *January 2005 - July 2011*
Department of Chemistry, Wichita State University, Wichita, KS

- Studied the factors affecting copper and zinc-induced apoptosis in neuronal cells
- Characterized SH-SY5Y neuronal cells as a serotonergic model
- Purified and characterized cytochrome b_{561} protein from natural sources for functional studies
- Studied the kinetics of cytochrome b_{561}

Research Officer *July 2001 -December 2004*
Industrial Technology Institute, Colombo, Sri Lanka

- Performed quantitative analysis on metals and minerals using ASTM, BS, SLS standards
- Provided test reports to industry
- Trained laboratory staff of two companies to perform testing

Research Assistant *October 2000- June 2001*
Environmental Technology Division, National Building Research Organization, Colombo, Sri Lanka

- Analyzed air pollutants by standard methods
- Provided test reports to industry

LABORATORY SKILLS

- Handling and maintenance of neuronal and nonneuronal cell lines (SH-SY5Y, MN9D, PC12)
- Basic methods in protein purification from natural sources
- Analytical and separation chromatography techniques including FPLC, HPLC-EC, HPLC-UV and GC/MS
- Spectroscopy (UV/VIS, CD, Fluorescence, Stopped flow, AAS)
- Electrophoresis
- Titration techniques

AWARDS AND AFFILIATIONS

- Member: Sigma Xi, 2012-2013
- Mellon funds to redesign general chemistry I course, 2011
- Lloyd Parker Graduate Fellowship in Chemistry, 2006-2008
- Member: American Association for the Advancement of Science, 2008-2011
- Student Affiliate Member: American Chemical Society, 2008-2011
- Outstanding Teaching Assistant, Spring-2009
- Junior Faculty Fellow, 2014-2015
- Professional Development Intensives, 2014

PUBLICATIONS/ PRESENTATIONS

- **Kollalpitiya, Yamuna** and Wimalasena, Kandatege, Neurotoxicity of Copper (II) and Zinc (II). 45th Midwest Regional Meeting of the American Chemical Society, Wichita, KS, October 27-30, 2010.

- **Kollalpitiya, Yamuna** and Wimalasena, Kandatege, Catecholaminergic Toxicity of Copper could not be due to its Redox Activity. Poster, 44th Midwest Regional Meeting of the American Chemical Society, Iowa City, IA, October 21-24, 2009.

- **Kollalpitiya, Yamuna** and Wimalasena, Kandatege. Membrane Permeable Chelators Increase Copper Uptake and Toxicity in Catecholaminergic Cells. Poster. 84th Southwestern and Rocky Mountain Division Regional Meeting of the American Association for the Advancement of Science, Tulsa, OK, March 28-31, 2009.

- **Kollalpitiya, Yamuna** and Wimalasena, Kandatege. Transport of Tryptophan into Neuronal cells. Poster. 4thAnnual Symposium on Graduate Research and Scholarly Projects, Wichita State University, April 25, 2008.

- **Kollalpitiya, K.M.Y.P.,** Kamaldeen, T. and Navarathne, A., Detection of Hydrogen Peroxide in Milk using a Biosensor. *Chemistry of Sri Lanka* (2000), 17, 41.

- **Kollalpitiya, K.M.Y.P.,** Kamaldeen, T. and Navarathne, A., Detection of Hydrogen Peroxide in Milk using a Biosensor. Poster. Annual Research Sessions, University of Perdeniya, Sri Lanka 2000.

COLLEEN M. PARTIGIANONI
Curriculum Vitae
July, 2015

Education

Ph. D., (1991) Chemistry, Michigan State University, East Lansing MI.
B.S., (1986), Chemistry, *magna cum laude*, Ithaca College, Ithaca NY.

Professional Experience

Ferris State University:
Professor of Chemistry: 2009 – present.
Associate Professor of Chemistry: 2004 – 2009.
Assistant Professor of Chemistry: 1999 – 2004.

Pellissippi State Community College: Adjunct Instructor 5 / 98 – 5 / 99.

Cornell University: Tutor, Learning Skills Center 1 / 98 – 5 / 98.

University of North Carolina: Visiting Professor 1 / 97 – 1 /98**;** 8 / 94 – 8/ 95
(one year appointments funded by Career Advancement and Visiting Professorship Awards from the National Science Foundation)

Ithaca College: Assistant Professor of Chemistry 8 / 91 – 8 / 94; 8 / 95 – 8 / 96.

Ferris Teaching Assignments

Chem 121 General Chemistry 1 (lecture and lab)
Fall Semesters: 1999 through 2014;

Chem 122 General Chemistry 2 (lecture and lab)
Spring Semesters: 2001 through 2015

Chem 381: Inorganic Chemistry: Spring 2010, Spring 2012, Spring 2014

Chem 497 Independent Study in Coordination Chemistry: Fall 04, Spring 08

Chem 114 Introduction to General Chemistry
1 section: (lecture and lab): Winter 05 & Summer 00.
3 sections: (lab): Winter 03.

Chem 103 Preparatory Chemistry (lecture and lab): Summer 00

Service

FSU Committee Service

Departmental (Recent)

2014-2015
- Assessment Committee (Chair)
- CHEM 121 and CHEM 122 Assessment Coordinator
- General Chemistry Faculty Search Committee
- B. A. in Biochemistry and Chemistry Program Review Committee

2013–2014
- Assessment Committee (Chair)
- CHEM 121 and CHEM 122 Assessment Coordinator
- Curriculum Committee

2012–2013
- Assessment Committee (Chair)
- CHEM 121 and CHEM 122 Assessment Coordinator
- Equipment Committee
- Tenure Policy Revision
- Tenure Review Committee
- Summer Teaching Committee

2011–2012
- Assessment Committee (Chair)
- Chem 122 Assessment Coordinator
- Equipment Committee
- Tenure Review Committee
- CTC for Gary Hiel (Chair)

2010—2011:
- Assessment Committee
- Chem 122 Assessment Coordinator
- Equipment Committte
- Tenure Review Committee
- CTC for Gary Hiel (Chair)

2009—2010:
- Assessment Committee
- Chem 122 Assessment Coordinator
- Equipment Committee
- Safety Committee
- Tenure Review Committee
- CTC for Gary Hiel (Chair)

2008—2009:
- Assessment Committee
- Equipment Committee
- Tenure Review Committee

College
CAS Assessment Committee (2011 – present)
CAS Sabbatical Leave Committee (2010—2011; 2006 – 2007)
CAS Diversity Committee (2008—2010)
CAS Academic Standards and Policies (2003 – 2006)
CAS Planning Committee (2001 – 2004)
CAS Faculty Support and Development (2000 – 2003), Recorder (2002 - 2003)

University
Scientific Understanding Assessment Committee (2002 – 2008)

Advising / Mentoring

Faculty Advisor for Kappa Psi Pharmaceutical Fraternity (Fall 2002 – present)

Mentor in Select Sixty (Fall 2005 – Winter 2006)

Research Advisor for an undergraduate student (Fall 2002 – Winter 2003)

Academic Advisor for approximately 20 pre-pharmacy students / year.

Honors/ Recognition

Excellence in Course Assessment Award (Spring 2011)

Semifinalist for Ferris' Distinguished Teacher Award, Spring 2007.

Recipient of the Outstanding Professor Award, FSU Honors Program, Fall 2004.

Scholarly and Professional Activities

Publications

A New Electron Transfer Donor for Photoinduced Electron Transfer in Polypyridyl Molecular Assemblies"; Colleen Partigianoni, Sandrine Chodorowski-Kimmes, Joseph A. Treadway, Durwin Striplin, and Thomas J Meyer, Inorg. Chem. **1999,** 38, 1193.

"Photoreduction of Diaryl Disulfides by Quadruply Bonded Dimolybdenum and Ditungsten Complexes"; Carolyn Hsu, Sarah A. Helvoigt, Colleen M. Partigianoni, Claudia Turro and Daniel Nocera, Inorg. Chem. **1995**, 34, 6186.

"Photoredox Chemistry of d^4 Bimetallic Systems"; Colleen M. Partigianoni, Claudia Turro, Carolyn Hsu, I-Jy Chang, and Daniel Nocera, Adv. Chem. Series (238), Kutal, ed, **1993,** 147**.**

"Photoredox Chemistry of Mixed Valency Systems"; Colleen Partigianoni, Claudia Turro, Yeung-gyo Shin, Douglas Motry, Janice Kadis, Joel I. Dulebohn, and Daniel G. Nocera, NATO ASI Series, Reidel Publishing Company: Amsterdam; **1991**, 91.

"Photoinduced Oxidative-Addition to a Quadruply Bonded Tungsten Complex $W_2Cl_4(dppm)_2$"; Colleen M.Partigianoni and Daniel Nocera, Inorg. Chem. **1990**, 29, 2033.

"Multielectron Photochemistry of Quadruply Bonded Metal-Metal Complexes"; Colleen M. Partigianoni, I-Jy Chang, and Daniel Nocera, Coord. Chem. Rev. **1990**, 97, 105.

Conference Presentations

"Overcoming Fear of Perceived Hurdles in Implementation of POGIL," Colleen Partigianoni, 20th Biennial Conference on Chemical Education, Bloomington, Indiana, July 27-31 2008.

"Overcoming Fear of Perceived Hurdles in Implementation of POGIL," Colleen Partigianoni, 234th American Chemical Society National Meeting, Boston, MA, August 19 – 23 2007.

"Ligand Effect on the Photoinduced Electron Transfer Reactions of Quadruply–Bonded Bimetallic Complexes," Colleen Partigianoni, 34th Great Lakes / Central Regional American Chemical Society Meeting, Ypsilanti, MI, June 26 – 29, 2002.

"Don't Slay Them – SLA Them," **Colleen Partigianoni**, David V. Frank, Lowell Jacobs, William Killian and Virginia Shepler, 33rd Great Lakes / Central Regional American Chemical Society Meeting Grand Rapids, Michigan, June 11 – 13, 2001.

"Increasing Student Success in General Chemistry Classes with Structure Learning Assistance (SLA) Workshops," **Colleen Partigianoni**, David Frank, Lowell Jacobs, Biennial Conference on Chemical Education, University of Michigan, Ann Arbor, Michigan, July 30 – August 3, 2000.

Conference Participation

2015 American Chemical Society Great Lakes Regional Meeting, Grand Rapids, MI, May 27 — 30, 2015

2014 Biennial Conference on Chemical Education, Grand Valley State University, Allendale, MI, August 3 – 7, 2014

2012 Biennial Conference on Chemical Education, Penn State University, University Park, PA, July 29 – August 2, 2012

12th Annual Texas A & M University Assessment Conference, College Station, Texas, Febuary 19 – 21, 2012

19th Biennial Conference on Chemical Education, Purdue University, West Lafayette, Indiana, July 29 – August 3, 2006.

American Association of Higher Education National Conference, "Learning in 3D: Democratic Transformations, Diversity Redefined, Digital Environments," San Diego, CA, April 1– 4, 2004.

Lilly Conference on College and University Teaching–West, California State Polytechnic University, Pomona, California, March 14 & 15, 2003.

Lilly Conference on College and University Teaching, The University of Georgia, Athens, Georgia, February 11 – 13, 2000.

External Workshop Participation

National Science Foundation Sponsored POGIL Workshop: ("Process Oriented Guided Inquiry Learning in the Laboratory), Berry College, Mount Berry, GA, July 15-17 2008.

National Science Foundation Sponsored POGIL Workshop: ("Process Oriented Guided Inquiry Learning in the Classroom and Laboratory), University of St. Thomas, St. Paul, Minnesota, June 23rd – June 25th, 2005.

National Science Foundation Sponsored POGIL Workshop, Grand Valley State University, Allendale, MI October 2, 2004.

Pearson Education / Benjamin Cummings General Chemistry Forum, Chicago, Illinois, November 13, 2004.

National Science Foundation: Multi-Initiative Dissemination Project, Innovations in Chemical Education, Central Michigan University, Mount Pleasant, Michigan, April 4 & 5, 2003.

National Science Foundation Sponsored Chautauqua Short Course: "Process Workshops: A New Model for the Science Classroom"; SUNY Stony Brook, Long Island NY, June 7 – 9, 2001.

Internal Workshop Participation (Center for Teaching, Learning and Faculty Development)

FerrisConnect Block Training, August 28 – 29, 2008.

Faculty Learning Community on Learner Centered Teaching, Fall 05 (45 hour course.)

"Getting Up to Speed with WEBCT," May 10–12, 2005.

Critical Thinking Workshop, Critical Thinking Institute at Ferris State University, Ferris State University, Big Rapids, Michigan, May 22 & 23, 2003.

"Test What You Teach, Teach What You Test," (3/ 04/ 02 — 4 / 29 / 02): 30 hour course.

New to Ferris Faculty Transition Program (Fall 2009)

Mark A. Thomson

Department of Physical Sciences
Ferris State University

EDUCATION:

Ph.D. Inorganic Chemistry. August 1995; Colorado State University, Fort Collins, Colorado.
Dissertation: Synthetic Models for the Resting Oxidized Form of the Dioxygen Binding Site in Cytochrome *c* Oxidase. Oren P. Anderson and C. Michael Elliott, Advisors.
Awards: Graduate Teaching Fellowship, Gustafson Graduate Teaching Award.

B.S. Chemistry. June 1987; University of Utah, Salt Lake City, Utah.

ACADEMIC EXPERIENCE:

Associate Professor, Chemistry. Department of Physical Science, Ferris State University, August 2011 to present.
Assistant Professor, Chemistry. Department of Physical Science, Ferris State University, August 2007 to August 2011.
Instructor, Chemistry. Department of Physical Science, Ferris State University, August 2006 to July 2007.
Instructor, Chemistry. Department of Chemistry and Physics, Southeastern Louisiana University, August 2003 to August 2006.
Instructor, Wet Science Gear Up. Southeastern Louisiana University, June and July 2005.
Instructor, Chemistry. Our Lady of Holy Cross College, August to December 2003.
Visiting Assistant Professor, Chemistry. Department of Chemistry and Physics, Arkansas State University, August 2002 to May 2003.
Assistant Professor, Chemistry. Department of Chemistry, Xavier University of Louisiana, August 1995 to August 2002.
Instructor, Chemistry. Division of Science, Louisiana State University at Alexandria, August 1994 to August 1995.
Instructor, Chemistry. Fort Polk Center, Northwestern State University of Louisiana, June to August 1995.

AREAS OF INTEREST AND EXPERTISE:

INSTRUCTION

- General Chemistry Lecture & Laboratory
- Applied Fermentation Chemistry
- Physical Chemistry
- Biochemistry
- Chemistry for Non-Science Majors
- K-12 Education in Science and Chemistry
- Environmental Chemistry

RESEARCH

- History and Application of Small-Scale Fermentation.
- Chemical Analysis Applications in the Fermentation Industry.
- Interdisciplinary Approaches to Pedagogy and Content.
- Preparation of K-12 Science Teachers including the use of Technology Resources

FERRIS STATE UNIVERSITY SERVICE:

Department of Physical Sciences

Program Coordinator, BS in Industrial Chemistry, 2015 to present
Assessment Committee, 2006-07, 2008-2012, 2013-2015
Curriculum Committee, 2008-09, 2012 to 2015
Faculty Development and Travel Committee, 2009-2012
Department Assessment Coordinator, 2008-2012
Planning Committee, 2007-08
General Chemistry Tenure-Track Search Committee, 2007-08

College of Arts and Sciences

New Student Orientation, 2012 to present
Pre-Pharmacy Advisor, 2007 to present
College Sabbatical Leave Committee, 2014 to 2015
College Promotion/Merit Committee, 2011 to 2015
Chair, 2011-2012, 2013-2015
College Curriculum Committee, 2012 to 2013
College Assessment Committee, 2008-2011
Chair, 2008-2011

University

Dean of the Library Search Committee, 2011-2012
Academic Program Review Council, 2011-2012
Pre-Pharmacy Task Force, 2011
Assessment Mentor 2009-2011

PROFESSIONAL ORGANIZATIONS:

American Chemical Society, Member since 1990
Joint Great Lakes Central Regional Meeting Executive Committee, 2013 to present
Program Co-Chair, 2013 - 2015
Committee on Technician Affairs, 2013 to present
Central Region Steering Committee, 2011 to present
Western Michigan Section, Councilor – 2007 to present
ACS Speaker Service, 2006 to the present.
Committee on Project SEED, 2008 - 2012
Louisiana Section, Chair Elect – 1999, Chair – 2000

Master Brewers Association of America, Member since 2012
American Society of Brewing Chemists, Member since 1999

PROFESSIONAL TRAINING:

ACS Leadership Development System
- "Leading Without Authority" May 27, 2015; Grand Rapids, MI.
- "Strategic Planning" March 18, 2014; Dallas, TX.
- "Developing Communication Strategies" September 9, 2013; Indianapolis, IN.
- "Engaging and Motivating Volunteers" September 9, 2013; Indianapolis, IN.

"Regional Meeting Planning Conference" November 1-3, 2013; Washington, DC, sponsored by the American Chemical Society.

"McGraw-Hill General Chemistry Symposium" March 1-3, 2013; San Diego, CA, sponsored by McGraw Hill Publishing.

"NCA-HLC Assessment Workshop" July 23-25, 2008; Lisle, IL.

"Summer Hands-On AP Chemistry Workshop" June 23-24, 2008; Baltimore, MD, sponsored by Vernier Software & Technology.

"Ferris Connect Training" June 5-6, 2007; Ferris State University, sponsored by the Faculty Center for Teaching and Learning.

"Scholarship of Teaching and Learning Faculty Learning Community" Spring 2007; Ferris State University, sponsored by the Faculty Center for Teaching and Learning.

"POGIL – Process Oriented Guided Inquiry Learning Workshop" March 24, 2007; Joliet Junior College, Joliet, IL.

"Computational and Theoretical Chemistry Workshop" May 15-20, 2005; Salt Lake City, Utah, sponsored by NSF and the Center for Workshops in the Chemical Sciences.

"Computer and Graphing Calculator Workshop" February 26, 2005; New Orleans, Louisiana, sponsored by Vernier Software & Technology.

"Medic-B Faculty Teaching Workshop" July 18-21, 2001; Boston, Massachusetts, sponsored by Indiana University.

"T.H.E. | QUEST Training Workshop" March 13-14, 29-30, April 14-15, 2000; University of Louisiana at Lafayette, sponsored by University of Louisiana at Lafayette and LaSIP.

CONFERENCE ATTENDANCE:

250th National Meeting, American Chemical Society, Boston, MA, August 16-20, 2015.

Joint Great Lakes Central Regional Meeting, American Chemical Society, Grand Rapids, MI, May 27-30, 2015.

249th National Meeting, American Chemical Society, Denver, CO, March 22-26, 2015.

248th National Meeting, American Chemical Society, San Francisco, CA, August 10-14, 2014.

247th National Meeting, American Chemical Society, Dallas, TX, March 16-20, 2014.

246th National Meeting, American Chemical Society, Indianapolis, IN, September 8-12, 2013.

American Society of Brewing Chemists Annual Meeting, Tucson, AZ, May 19-28, 2013.

44th Central Regional Meeting, American Chemical Society, Mt. Pleasant, MI, May 15-18, 2013.

245th National Meeting, American Chemical Society, New Orleans, LA, April 7-11, 2013.

Michigan Academy of Science, Arts, and Letters Annual Meeting, Holland, MI, March 22, 2013.

244th National Meeting, American Chemical Society, Philadelphia, PA, August 19-23, 2012.

WBC 2012, American Society of Brewing Chemists and Master Brewers Association of the Americas, Portland, OR, July 28-August 1, 2012.

43rd Central Regional Meeting, American Chemical Society, Dearborn, MI, June 6-9, 2012.

243rd National Meeting, American Chemical Society, San Diego, CA, March 25-29, 2012.

242nd National Meeting, American Chemical Society, Denver, CO, August 28-September 1, 2011.
42nd Central Regional Meeting, American Chemical Society, Indianapolis, IN, June 8-10, 2011.
241st National Meeting, American Chemical Society, Anaheim, CA, March 27-31, 2011.
240th National Meeting, American Chemical Society, Boston, MA, August 22-26, 2010.
239th National Meeting, American Chemical Society, San Francisco, CA, March 21-25, 2010.
9th Annual Lilly Conference, Traverse City, MI, September 24-27, 2009.
238th National Meeting, American Chemical Society, Washington, DC, August 16-20, 2009.
237th National Meeting, American Chemical Society, Salt Lake City, UT, March 22-26, 2009.
2008 Assessment Institute, IUPUI, Indianapolis, IN, October 25-28, 2008.
236th National Meeting, American Chemical Society, Philadelphia, PA, August 17-21, 2008.
235th National Meeting, American Chemical Society, New Orleans, LA, April 6-April 10, 2008.
234th National Meeting, American Chemical Society, Boston, MA, August 19-23, 2007.
38th Central Regional Meeting, American Chemical Society, Cincinnati, OH, May 20-23, 2007.
233rd National Meeting, American Chemical Society, Chicago, IL, March 25-29, 2007.

STUDENT RESEARCH SUPERVISION AND PRESENTATIONS:

Lucas Woodcock, Big Rapids, MI. February 2015 to April 2015.

"Effect of Putrescine Oxidase Active Site Mutations on Activity." As presented at the 249th National Meeting of the American Chemical Society, Denver, CO March 22-26, 2015 (Research conducted with Dr. Kim Colvert)

College of Arts and Sciences Student Research Grant, Ferris State University, Applied for January 18, 2015. $750 for travel to ACS National Meeting in Denver, CO March 22-26, 2015

Jacob Longnecker, Ferris State University, Big Rapids, MI. May 2014 to August 2014.

Student Research Fellowship, Ferris State University, May 2014 to August 2014.

"Determining typical pH ranges throughout the brewing process for brown ale and American pale ale style beers." As presented in the Student Research Fellowship Seminar, Ferris State University, August 20, 2014

Symon Cronk, Ferris State University, Big Rapids, MI. May 2014 to August 2014.

Student Research Fellowship, Ferris State University, May 2014 to August 2014.

"Addition of gypsum and its effect on pH and flavor perception in American amber ale." As presented in the Student Research Fellowship Seminar, Ferris State University, August 20, 2014

Spencer Crittendon, Ferris State University, Big Rapids, MI. January 2013 to August 2013.

Student Research Fellowship, Ferris State University, May 2013 to August 2013.

Student Research Assistantship, Ferris State University, January 2013 to May 2013.

"Analysis of Yeast Available Nitrogen and its Effect on Wine Fermentation." As presented in the Student Research Fellowship Seminar, Ferris State University, August 21, 2013

Kim Johnson and Joe Saviano, Ferris State University, Big Rapids, MI. September 2012 to April 2013.

"Acquire the practical laboratory skills and knowledge needed for the chemical industry with an associate's in Industrial Chemistry Technology alongside a bachelor's degree." As presented at the 245th National Meeting of the American Chemical Society, New Orleans, LA, April 7-11, 2013

College of Arts and Sciences Student Research Grant, Ferris State University, Applied for February 5, 2013. $1500 for travel to ACS National Meeting in New Orleans, LA April 7-11, 2013

Caleb Archambalt, Ferris State University, Big Rapids, MI. May 2011 to May 2013.

College of Arts and Sciences Student Research Grant, Ferris State University, Applied for February 5, 2013. $750 for travel to ACS National Meeting in New Orleans, LA April 7-11, 2013

I&EC Travel Grant, American Chemical Society, April, 2013. $1000 for travel to present at the 245th National Meeting of the American Chemical Society, New Orleans, LA, April 7-11, 2013

Student Research Assistantship, Ferris State University, October 2012 to May 2013.

"Development and Improvement of Protocols and Methodologies for Chemical Analysis in the Fermentation Industry." As presented in the Student Research Fellowship Seminar, Ferris State University, August 22, 2012

Student Research Fellowship, Ferris State University, May-to July, 2012. $6000 for stipend, travel, and supplies

"Factors effecting the carbonation rate of non-alcoholic sodas or carbonated beverages." As presented at the 243rd National Meeting of the American Chemical Society, San Diego, CA, March 25-29, 2012

I&EC Student Travel Grant, American Chemical Society, March, 2012. $500 for travel to present at the 243rd National Meeting of the ACS in San Diego, CA

College of Arts and Sciences Student Research Grant, Ferris State University, June 2011-to May, 2012. $750 for travel and supplies

Tyler Weatherwax, Ferris State University, Big Rapids, MI. August 2011 to April 2012.

"Fermentation in High School: I Hope it Doesn't Explode!" As presented at the 243rd National Meeting of the American Chemical Society, San Diego, CA, March 25-29, 2012

College of Arts and Sciences Student Research Grant, Ferris State University, June 2011-to May, 2012. $750 for travel and supplies

Steven Lingenfelter, Ferris State University, Big Rapids, MI. August 2010 to April 2011.

"The Promotion of Undergraduate Research at Teaching Institutions." As presented at the 241st National Meeting of the American Chemical Society, Anaheim, CA, March 27-31, 2011

I&EC Student Travel Grant, American Chemical Society, March, 2011. $1000 for travel to present at the 241st National Meeting of the ACS in Anaheim, CA

CONSULTATION/COLLABORATION EXPERIENCE:

Crankers Brewery, Big Rapids, MI. May 2012 to present. Collaboration has resulted in analytical chemistry research by FSU student Caleb Archambalt, both on-site and in research labs at FSU during the summer of 2012.

The Blue Cow Café, Big Rapids, MI. October 2008 to May 2010. Consultation resulted in discussions and presentations on the chemistry of fermentation, especially as it applies to the production of beer. The presentations have included discussion of beer evaluation, regional beer styles, and beer – food pairings at beer dinners and monthly beer style discussion groups.

Dillard University, New Orleans, LA. October 2003 to June 2009. Environmental Chemistry Education collaboration with Dr. José Ramirez to develop a new Ecology Lab Manual incorporating experiments in environmental chemistry for use in the Biology curriculum at Dillard University. The collaboration has also included guest lectures on various occasions on Acid Rain and on Ecology from a Chemistry perspective.

Flint Community Schools, Genesee Area Skill Center, and Dillard University. October 2006 to April 2007. Environmental Studies collaboration with Dr. José Ramirez (DU) and Joyce Dudley (GASC) to enhance the environmental education studies of approximately 20 High School students through soil and water field testing in post-Katrina New Orleans, Louisiana.

GRANT EXPERIENCE:

Computerized Data Collection for CLAB 123 and CLAB 124, Inorganic Chemistry Lab I & II. Co-Investigator, Dr. Tino Ladogana, Student Technology Fee Program, Southeastern Louisiana University, December 2004, $30445.55. Proposal to enhance the pedagogy employed in CLAB 123 and CLAB 124 by the acquisition of new computer-based data collection probes and software.

PUBLISHED COURSE MATERIAL:

Thomson, M. A. *CHEM 121 Laboratory Manual*, V. 4.; Ferris Copy Center, Big rapids, MI, 2015.

Thomson, M. A. *CHEM 122 Laboratory Manual*, V. 2.; Ferris Copy Center, Big rapids, MI, 2015.

Adams, M. R.; Allen, L. R.; Bauer, J.; Carmichael, JW Jr.; Henry, S.; Sevenair, J. P.; Thomson, M. A. *General Chemistry Laboratory Manual*, 13th ed.; Stipes Publishing Company: Champaign, IL, 2009.

Adams, M. R.; Allen, L. R.; Bauer, J.; Carmichael, JW Jr.; Sevenair, J. P.; Thomson, M. A. *General Chemistry II Laboratory Manual*; 4th ed.;Stipes Publishing Company: Champaign, IL, 2004.

Adams, M. R.; Bauer, J.; Bean, K. S.; Carmichael, JW Jr.; Eduok, E.; Henry, S.; Howell, D.; Klassen, B.; Privett, J. A.; Sevenair, J. P.; Thomson, M. A. *Handbook for General Chemistry Volume I: Chemistry 1010*, 15th ed.; Stipes Publishing Company: Champaign, IL, 2003.

Adams, M. R.; Bauer, J.; Bean, K. S.; Carmichael, JW Jr.; Eduok, E.; Henry, S.; Howell, D.; Isovitsch, R.; Privett, J. A.; Sevenair, J. P.; Thomson, M. A. *Handbook for General Chemistry Volume II: Chemistry 1020*, 16th ed.; Stipes Publishing Company: Champaign, IL, 2003.

Allen, L. R.; Bauer, J.; Carmichael, JW Jr.; Sevenair, J. P.; Thomson, M. A. *Qualitative Inorganic Analysis Laboratory Manual*, 4th ed.; Stipes Publishing Company: Champaign, IL, 1997.

BOOK CHAPTERS:

Thomson, M. A; Killian, W. Transitioning Culture: Teaching and Modeling Workplace Behavior. In Moore, M.; Leesma, E (Eds.), "Academia and Industrial Pilot Plant Operations and Safety." ACS Symposium Series; American Chemical Society, Washington, DC; 2014.

Thomson, M. A. The 'Science' and 'Art' of Teaching and Learning at Xavier University of Louisiana. In Lenoar Foster, Janet A. Guyden, and Andrea L. Miller (Eds.), "Affirmed Action: Essays on the Academic and Social Lives of White Faculty Members at Historically Black Colleges and University." Lanham, MD: Rowman & Littlefield Publishers, Inc, 1999.

RESEARCH PUBLICATIONS:

Trautmann, N. M.; Carlsen, W. S.; Eick, C. J.; Gardner, F. E. Jr.; Kenyon, L.; Moscovici, H.; Moore, J. C.; Thomson, M. A.; West, S. S. "Online Peer Review: Learning Science As It's Practiced." *Journal of College Science Teaching*, **2003**, *32*, 443-447.

Thomson, M. A.; Kar, M.; Anderson, O. P.; Lenz, T.; Vaughan, J. D. "The Structure of phenyl maleic anhydride" *Acta Cryst., Cryst. Struct. Commun.* **1996**, *C52*, 168-169.

Mylrajan, M.; Andersson, L. A.; Sun, J.; Loehr, T. M.; Thomas, C. S.; Sullivan, E. P., Jr.; Thomson, M. A.; Long, K. M.; Anderson, O. P.; Strauss, S. H. "Resonance Raman Spectroscopic Core-Size Correlations for the Crystallographically Defined Complexes Fe^{II}(OEP), Fe^{II}(OEC), Fe^{III}(OEP)(NCS), and $[Fe^{III}(OEP)(N\text{-MeIm})_2]^+$, $[Fe^{III}(OEP)(DMSO)_2]^+$." *Inorg. Chem.* **1995**, *34*, 3953-3963.

Thomson, M. A.; Anderson, O. P. "Structure of Carba-bicyclomycin I." *Acta Cryst., Cryst. Struct. Commun.* **1991**, *C47*, 1984-1986.

Thomson, M. A.; Anderson, O. P. "Structure of Benzyl 3-Benzyl-3-methyl-2-oxo-5,6-diphenylmorpholin-4-ylcarboxylate." *Acta Cryst., Cryst. Struct. Commun.* **1991**, *C47*, 1996-1998.

Thomson, M. A.; Anderson, O. P. "The Structure of a Model for Aspirochlorine (Antibiotic A30641)." *Acta Cryst., Cryst. Struct. Commun.* **1991**, *C47*, 2003-2005.

Thomson, M. A.; Anderson, O. P. "The Structure of 1-(Methoxymethyl)-16,17-didehydro-19-oxoalloyohimbane" *Acta Cryst., Cryst. Struct. Commun.* **1991**, *C47*, 2494-2495.

Thomson, M. A.; Anderson, O. P. "The Structure of (4S,4'S,5'S) 3–(5'–Benzyloxy–5'–methyl– 2'–oxo–2',3',4',5'–tetrahydro–4'-furyl)–4–phenyl–1,3–oxazolidin–2–one" *Acta Cryst., Cryst. Struct. Commun.* **1991**, *C47*, 2496-2497.

PRESENTATIONS:

"The role of flavoring agents in carbonation rate for yeast carbonated non-alcoholic soda; a general chemistry experiment with interesting problems." With Caleb Archambault and Tyler Weatherwax, as presented at the 75th American Society of Brewing Chemists Annual Meeting, Tucson, AZ, May 19-22, 2013.

"Establishing a culture: Teaching and modeling safe workplace behavior." As presented at the 245th National Meeting, American Chemical Society, New Orleans, LA, April 7-11, 2013.

"Industrial Chemical Technology at Ferris State University: past, present and future." With Bill Killian, Pasquale Di Raddo, and Dave Frank, as presented at the Michigan Academy of Science, Arts, and Letters Annual Conference, Holland, MI, March 22, 2013.

"The Chemistry of Beer." As presented to the FSU Student Affiliates of the American Chemical Society, Big Rapids, MI, February 7, 2013.

"Is it Beer? Is it Wine? Investigations into Native American Fermentation Traditions." As presented at the November Meeting of the Western Michigan Section of the American Chemical Society, Spring Lake, MI, November 8, 2012.

"¿Qué Hay en mi Sopa? Dispersión de Contaminantes Químicos por Inundación." As presented in the Día Mas Verde Seminar Series at Universidad Interamericana, Recinto de Ponce, Ponce, PR, October 6, 2010.

"Is it Beer? Is it Wine? Investigations into Native American Fermentation Traditions." As presented at the 240th National Meeting of the American Chemical Society, Boston, MA, August 22-26, 2010.

"What Makes Beer Beer? An Introduction to Fermentation Chemistry." As presented to the FSU Student Affiliates of the American Chemical Society, Big Rapids, MI, April 21, 2010.

"Hurricane Katrina: A Natural or Man-Made Catastrophe. A Personal and Academic Perspective." As presented in the Science Today Seminar Series at SUNY-Oswego, Oswego, NY, April 1, 2009.

"The Role of Chemistry in the Development of Regional Styles of Beer and Ale." As presented to the STEM Scholarship Recipients at Ferris State University, Big Rapids, MI, March 19, 2009.

"The Role of Chemistry in Producing Different Styles of Beer and Ale." As presented at the 235th National Meeting of the American Chemical Society, New Orleans, LA, April 6-April 10, 2008.

"Chicha: Pre-Columbian Brewing Traditions of South America." As presented at the 235th National Meeting of the American Chemical Society, New Orleans, LA, April 6-April 10, 2008.

"The Fine Art of Brewing, or, What is Beer?" As presented at the September Meeting of the Western Michigan Section of the American Chemical Society, Holland, MI, September 25, 2007.

"Chicha: South American Brewing Traditions that Predate European Influences." As presented at the 39th Central Regional Meeting of the American Chemical Society, Cincinnati, OH, May 20-23, 2007.

"What Makes Beer Beer? An Introduction to Fermentation Chemistry." As presented to the FSU Student Affiliates of the American Chemical Society, Big Rapids, MI, February 22, 2007.

"The Role of Chemistry in the Development of Regional Styles of Beer and Ale." As presented at the March Meeting of the Sabine-Neches Section of the ACS, Beaumont, TX, March 31, 2005.

"The Role of Chemistry in Beer Stability and the Development of Regional Styles of Beer and Ale." As presented at the September Meeting of the Louisiana Section of the ACS, New Orleans, LA, September 28, 2004.

Hale, R. P.; Thomson, M. A.; Rodrigue, S.; Kocic, V.; Eschenazi. E. "A Collaborative Approach Between Education, Science and Mathematics Faculty to Provide Professional Development Activities for Pre-service and Veteran Teachers." As presented at the Ninth National HBCU Faculty Development Symposium, Nashville, TN, October 17-20, 2002.

Hale, R. P.; Bordelon, D. E.; Carmichael, M. C.; Thomson, M. A. "Curriculum Redesign - A Collaborative Approach Between Education and Arts and Sciences Faculty." As presented at the Ninth National HBCU Faculty Development Symposium, Nashville, TN, October 17-20, 2002.

Carlsen, W.; Trautmann, W.; Abrams, E.; Ahern, K.; Dekkers, P.; Eick, C.; Gardner, F.; Ghosh, N.; Kenyon, L.; Moore, J.; Moscovici, H.; Thomson, M.; West, S.; Yalvac, B. "Peer Review by

College Students in Science and Science Education: A Multi-Institutional R & D Project." As presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, April 1-5, 2002.

Thomson, M.; Black, L. "Study Abroad at HBCU Institutions in the Sciences: Collaborating to Breakdown Barriers." As presented at the Eighth National HBCU Faculty Development Symposium, Norfolk, VA, October 18-21, 2001.

Thomson, M.; Fulwiler, J. "Working Together to Improve Middle School Science and Math Education." As presented at the Seventh National HBCU Faculty Development Symposium, Jackson, MS, October 19-22, 2000.

Anderson, T.; Bales, F.; Foster, L.; Frank, F.; Guyden, J.; Henzy, K.; Redinger, M.; Rozman, S.; Sides-Gonzales, K.; Silvergate, J.; Thomson, M.; Ziegler, W. "White Faculty at Historically Black Colleges and Universities: Academic and Social Lives." As presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, April 24-28, 2000.

Humphrey, J. H.; Ramirez-Domenech, J.; Thomson, M. "The Across The Curriculum Thinking Program: Interdisciplinary Interactions at Xavier University." As presented at the Winter Conference, "How Learning Happens: Making Connections, Constructing Knowledge, Building Community," of The Collaboration for the Advancement of College Teaching and Learning, Bloomington, MN, November 19-20, 1999.

Thomson, M.; Bean, S.; Privett, A. "The First-Year Experience for Chemistry Students at Xavier University." As presented at the 215th National Meeting of the American Chemical Society, Dallas, TX, March 29-April 3, 1998.

Thomson, M.; Okon, S. "Letting the Cat Out of the Bag: Do Our Students Know What We Want Them to Know?" As presented at the Spring Conference, "Teaching Key Concepts Within and Across Disciplines," of The Collaboration for the Advancement of College Teaching and Learning, Bloomington, MN, February 19-20, 1998.

AMERICAN CHEMICAL SOCIETY SPEAKER SERVICE PRESENTATIONS:

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the October Meeting of the St. Joseph Valley Section of the ACS, South Bend, IN, October 29, 2009.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the October Meeting of the Puget Sound Section of the ACS, Olympia, WA, October 21, 2009.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the October Meeting of the Portland Section of the ACS, Portland, OR, October 20, 2009.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the October Meeting of the Richland Section of the ACS, Richland, WA, October 19, 2009.

"What Kind of Beer Am I Drinking? Is it Good? And What Makes a Beer Good Anyway? An Introduction to the Beer Evaluation." As presented at the November Meeting of the Greater Houston Section of the ACS, Houston, TX, November 13, 2008.

"What Kind of Beer Am I Drinking? Is it Good? And What Makes a Beer Good Anyway? An Introduction to the Beer Evaluation." As presented at the November Meeting of the Brazosport Section of the ACS, Lake Jackson, TX, November 12, 2008.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the November Meeting of the South Texas Section of the ACS, Corpus Christi, TX, November 11, 2008.

"What Kind of Beer Am I Drinking? Is it Good? And What Makes a Beer Good Anyway? An Introduction to the Beer Evaluation." As presented at the November Meeting of the San Antonio Section of the ACS, San Antonio, TX, November 10, 2008.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the March Meeting of the Lake Superior Section of the ACS, Duluth, MN, March 7, 2008.

"What Kind of Beer Am I Drinking? Is it Good? And What Makes a Beer Good Anyway? An Introduction to the Beer Evaluation." As presented at the March Meeting of the La Crosse-Winona Section of the ACS, La Crosse, WI, March 6, 2008.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the March Meeting of the Central Wisconsin Section of the ACS, Marshfield, WI, March 5, 2008.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the March Meeting of the Milwaukee Section of the ACS, Milwaukee, WI, March 4, 2008.

"The Role of Chemistry in the Development of Regional Beer Styles, or "What is Beer (to a Chemist)?" As presented at the March Meeting of the Northeast Wisconsin Section of the ACS, Oshkosh, WI, March 3, 2008.

David Frank
Physical Sciences Department
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Employment History:

July 1992 – present: Department Head, Physical Sciences Department, Ferris State University, Big Rapids MI. Supervise faculty and staff in a 20-plus-member department in the areas of chemistry, biochemistry, industrial chemistry, physics, geology, astronomy and physical science.

July 2012 - June 2013: Interim Associate Dean, College of Arts and Sciences, Ferris State University, Big Rapids MI.

July 2003 – June 2008: Interim Department Head, Mathematics Department, Ferris State University, Big Rapids MI.

June 1997 – August 1997: Interim Department Head, Humanities Department, Ferris State University, Big Rapids MI.

Sept. 1985 – June 1992: Assistant/Associate Professor of Chemistry, Physical Sciences Department, Ferris State University, Big Rapids MI.

Aug. 1981 – June 1982: Chemistry Instructor, West Lafayette High School, W. Lafayette, IN.

Sept. 1978 – May 1984: Teaching Assistant, Chemistry Department, Purdue University, W. Lafayette IN.

Education:

Ph.D., Chemistry Education, Purdue University, W. Lafayette IN. (Dissertation Title: Implementing Instruction to Improve the Problem-Solving Abilities of General Chemistry Student. Dissertation advisor: J. Dudley Herron)

M.S., Chemistry, Purdue University, W. Lafayette IN.

B.A., *summa cum laude*, major in chemistry (minors in biology and mathematics), Macalester College, St. Paul MN.

Courses taught at Ferris State University:

Chemistry: Majors-level general chemistry, general chemistry for allied health, physical chemistry
Industrial chemistry: Chemical calculations, the chemical industry
General physics labs (both first and second semester)
Supervision of student teachers (mathematics, chemistry, biology, general science)
Freshman (orientation) seminar

Memberships in Professional/Honorary Organizations:

American Chemical Society
National Science Teachers' Association (NSTA)
Michigan Science Teachers' Association (MSTA)

Phi Beta Kappa

Grants/Funding (since 1999)

Adsmond, D., Frank, D. V. & Balanda, P. (2002-2005). FT-NMR upgrade for a collaborative research-based organic chemistry 2 laboratory course: Development and implementation. NSF (National Science Foundation) Grant No. DUE-0126961. Funded for: $46,675.

Killian, W., Frank, D., Di Raddo, P. & Weaver, J. (2001-2002). Dow Foundation Grant for student scholarships, student research, ICT (Industrial Chemistry Technology) web page development, Instrumental Analysis course support (including laboratory manual development) and partial support for FT-NMF instrument purchase. Funded for $25,000.

Killian, W., Frank, D. & Di Raddo, P. (2000-2001). Dow Foundation Grant for student scholarships, ICT web page development and Instrumental Analysis course support. Funded for $14,700.

Frank, D., Goosen, R., Lowery, G. & Andrews, T. (1999-2001). Connecting with the learner: The implementation of an equity toolkit in west-central Michigan. Eisenhower grant for $87,000.

Publications (since 1999)

Burns, F. & Frank, D. (2013). "The use of electronic media for chemical education research," *Chemistry Education and Sustainability in the Global Age,* pp. 185-195.

Padilla, M. J., Miaoulis, I. & Cyr, M. (program authors); Frank, D. V., Little, J. G & Miller, S. (book authors) (2005). *Prentice Hall Science Explorer: Chemical Building Blocks*. Pearson Education, Inc., Upper Saddle River NJ.

Padilla, M. J., Miaoulis, I. & Cyr, M. (program authors); Frank, D. V., Little, J. G & Miller, S. (book authors) (2005). *Prentice Hall Science Explorer: Chemical Interactions*. Pearson Education, Inc., Upper Saddle River NJ.

Wysession, M., Frank, D. & Yancopoulos, S. (2004). *Physical Science: Concepts in Action* (a textbook for students in secondary school). Pearson Education, Inc., Upper Saddle River NJ.

Frank, D. (head writer); Edmond, M. & Starr, W. (section writers) (2003). Section 2: "Designing Equitable Curriculum." One of six sections in the CD-ROM *Connecting With The Learner: An Equity Toolkit*. Produced by the North Central Regional Educational Laboratory.

Frank, D. & Killian, W. "Highlighted Program: The Industrial Chemistry Technology Program at Ferris State University." Article appearing in *Newsletter for Chemistry Technician Instructors,* Volume 11, No. 1, Spring 1999, p. 4.

Presentations/Workshops (since 1999)

Burns, F., Frank, D., Asare, J. & Clark, L. (2015, May). Assessing higher order thinking skills through creative writing. Presented at the 2015 Joint Great Lakes/Central Regional Meeting of the American Chemical Society.

Adsmond, D, Balanda, P. & Frank, D. (2014, October). Design of a collaborative research-based Organic Chemistry 2 laboratory course at Ferris State University. Presented at the International Scientific School Program, Kazan National Research Technological University, Kazan Russia.

Frank, D. & Adsmond, D. (2014, October). Higher Education in the USA: And how Ferris State University fits into the big picture. Presented at the International Scientific School Program, Kazan National Research Technological University, Kazan Russia.

Burns, F. & Frank, D. (2014, July). Chemical stories: Better chemistry through creative writing. Presented at the International Conference on Chemical Education, Toronto ON.

Di Raddo, P., Thomson, M., Killian, W. & Frank, D. (2013, March). Industrial Chemistry Technology at Ferris State University: past, present and future. Presented at the annual conference of the Michigan Academy of Science, Arts & Letters, Holland MI.

Burns, F. & Frank, D. (2010, August). The use of electronic media for chemical education research. Presented at the 21st International Conference for Chemical Education, Taipei, Taiwan.

Burns, F., Frank, D., Kerr, T. & Stanislav, T. (2008, August). The effect of online learning logs on student outcomes in general chemistry. Presented at the 20th Biennial Conference for Chemical Education, Bloomington IN.

Adsmond, D., Balanda, P. & Frank, D. (2004, August). Outcomes and analysis of a 2-year pilot of a collaborative research-based Organic Chemistry 2 laboratory course at Ferris State University. Presented at the 228th National Meeting of the American Chemical Society, Philadelphia PA.

Balanda, P., Adsmond, D. & Frank, D. (2004, July). Research projects in an Organic Chemistry 2 laboratory. Poster presented at the 18th Biennial Conference on Chemical Education (BCCE), Iowa State University, Ames IA.

Adsmond, D., Balanda, P. & Frank, D. (2004, July). Implementation of a collaborative research-based Organic Chemistry 2 laboratory course at Ferris State University. Presented at the 18th Biennial Conference on Chemical Education (BCCE), Iowa State University, Ames IA.

Christafferson, J. & Frank, D. (2001, November) An inquiry-based course in physical science for pre-service elementary teachers. Presented at the annual meeting of the Project 30 Alliance, Washington DC.

Frank, D., Christafferson, J., & Heck, F. (2001, June). Cooperative-learning and inquiry-based science courses for preservice teachers. Presented at the 33rd Central/Great Lakes Joint Regional Meeting of the American Chemical Society, Grand Rapids MI.

Killian, W., Di Raddo, P., Frank, D. & Hoekstra, M. (2001, June). Meeting the challenges for chemical technicians with an innovative certificate program. Presented at the 33rd Central/Great Lakes Joint Regional Meeting of the American Chemical Society, Grand Rapids MI.

Partigianoni, C., Frank, D., Jacobs, L., Killian, W. & Shepler, V. (2001, June). Don't slay them — SLA them! Presented at the 33rd Central/Great Lakes Joint Regional Meeting of the American Chemical Society, Grand Rapids MI.

Signature Page

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My signature below indicates that I was a contributing member of the Program Review Panel responsible for completion of the final Academic Program Review report submitted for review by the Academic Program Review Council, Academic Senate, Provost, and President of Ferris State University and attest to its completeness and soundness:

Kim Colvert, PRP Co-Chair/Program Coordinator — 9/2/15 Date
231.591.2580 colvertk@ferris.edu

David Frank, Department Head Physical Sciences — 9/2/15 Date
231 591 2580 frankd@ferris.edu

Dan Adsmond, PRP Co-Chair/ Program Coordinator — 9/2/15 Date
231 591 2580 adsmondd@ferris.edu

Colleen Partigianoni, Program Faculty — 9/2/15 Date
231 591 2580 partigic@ferris.edu

Joseph Saviano, Biosolutions, Outside Member — 9/1/15 Date
616 844 3478 joe.saviano@biosolutionsllc.com

My signature below indicates that I have reviewed the Academic Program Review report submitted for review by the Academic Program Review Council, Academic Senate, Provost, and President of Ferris State University and attest to its completeness and soundness:

Joseph Karafa, Acting Dean, College of Arts & Sciences — Date

231 591 3661 karafaj@ferris.edu