

*Institutional Effectiveness Report  
Academic Year 2010-2011  
Undergraduate Chemistry*

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*Mission and Goals*

The Department of Chemistry offers lower-level courses appropriate for general education and upper-level courses for major and minor programs in chemistry. These courses also serve as foundation courses for majors in other areas such as biology, mathematics, and pre-professional programs. Topics and concepts on the fundamental laws of nature that govern the physical universe and on the methods of scientific inquiry used to investigate and develop those laws are the foundations of course content. A basic understanding of the fundamental laws of nature and a basic understanding of the process of scientific inquiry are essential parts of a liberal arts education.

The chemistry program seeks to offer courses in chemistry that are taught by full-time faculty members with appropriate advanced degrees dedicated to science education at the university level. The courses offered in the department range in level from introductory courses that expose non-science majors to scientific thought to advanced courses that cover current and complex topics in modern chemistry. The laboratory experience is required in appropriate courses to illustrate the importance of experimentation to the scientific endeavor. For the majors in chemistry, the opportunity to undertake undergraduate research is offered. Since part of the research is the interpretation and communication of results, majors graduating from those programs in the department are expected to be proficient in oral and written communication, to be familiar with the scientific literature, and to be aware of the importance and usage of computers in science.

Those students completing either of the two major tracks offered by the Department of Chemistry are prepared to enter into any number of career choices. These include science education at the secondary level; work in local, region, and national industries and with governmental agencies; and entrance into graduate or professional schools.

The current chemistry curriculum consists of two tracks. The first is the track leading to the basic or minimal chemistry major. The second track is the curriculum leading to the American Chemical Society (ACS) certified degree. The ACS-certified degree requires additional advanced course work in chemistry, physics, and mathematics.

## *Assessment Activities*

For 2010-2011, the department modified the primary assessment tools for program evaluation in the chemistry capstone course (CHEM 499). The Diagnostic of Undergraduate Chemical Knowledge (American Chemical Society) was administered to graduating seniors. In addition, each student was required to give a 20 minute presentation on a topic in the current chemistry literature.

During the Spring 2011 semester the Diagnostic of Undergraduate Chemical Knowledge exam was administered to the five students enrolled in the CHEM 499 Chemistry capstone course. The scores ranged from the 3<sup>rd</sup> to 70<sup>th</sup> percentile with an average at the 23<sup>rd</sup> percentile. We will continue to look at different ways to motivate the students and to help the students review for taking this Diagnostic Exam.

The oral presentations were much improved this year in terms of quality. A rubric was given to the students to help in their presentations. This year we also had the students do a practice presentation to each other. They obviously benefited from the feedback and suggestions. The faculty will continue to look at ways of addressing oral presentations in lower level courses to help improve presentation skills.

Based on each of these assessment tools, the faculty will look at different strategies of reviewing the content from the major areas in chemistry in the CHEM 499 course. We will continue to encourage students to take additional advanced coursework and to participate in research activities.

### *Primary Issues Identified During 2010-2011 with a Review of Actions Taken During 2010-2011 for the Department of Chemistry*

| <b>Issues of Concern<br/>2010-2011</b>                                 | <b>Actions Taken</b>  |
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| New faculty need to be hired as a result of changes in teaching loads. | Budget constraints continue to delay the hiring of additional full-time faculty. Three adjunct faculty members were used to cover additional sections during the 2010-2011 academic year.   |
| Trailer sections need to be offered for general and organic classes.   | CHEM 102 was offered as a trailer for the first time during the fall of 2010. Two trailer sections of CHEM 101 were offered during the spring of 2011. CHEM 201 was offered as a trailer for the first time during the spring of 2011. In addition CHEM 102 is being offered during Summer I 2011. Based on the large enrollment numbers and student feedback, it appears that trailer sections are needed. However, these trailer sections can not be fully implemented without hiring additional faculty. |

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| <p>The Tutoring Program needs to continue to be developed for assisting students in the lower level chemistry lectures and laboratories.</p> | <p>The chemistry department at FMU continued to offer a tutoring center using the funds provided by the State of SC Fund for Women and Minorities in Science and Mathematics. Tutors provided assistance with general and organic chemistry homework and laboratories. Seven tutors (four Student Affiliate of the American Chemical society members + three nonmembers) led by one faculty member assisted approximately 175 students from September 2010 to April 2011.</p>  |
| <p>Increase membership and participation in the Student Affiliate Section of the American Chemical Society</p>                               | <p>Dr. Jennifer Kelley and Dr. T. J. Anderson served as faculty advisors of the Student Affiliate chapter of the ACS. For 2010-2011, there were a total of 39 chapter members (15 ACS student affiliates and 24 non-student affiliates).</p> <p>Recruitment and retention were achieved by having professors announce the first meeting of the semester in chemistry lectures. Flyers were also posted in various locations around campus. A social in the Fall was held for recruitment as well as many other activities throughout the year. The Student Affiliate Section also was represented at the Student Organization Fair. The Student Affiliate Section also has a Facebook page (Francis Marion University American Chemical Society) to improve our web presence and awareness about the group's activities. In addition, email addresses were collected this year and used to promote affiliate activities. The FMU Student Affiliate had the highest member enrollment since reactivating the group three years ago.</p>   |
| <p>Increase the Chemistry department's ties with the scientific community</p>  | <p>The Department sponsored two speakers for the Science Symposium this year. Tim Liam from Emory University spoke on 9/23/10. Dr. Liam spoke on the "Physical Chemistry of Solar Energy Conversion Using Nanomaterials." On 2/24/11 Tim Fuhrer from Emory University spoke on "Dependence of Energetics and Cluster Properties of Endohedral Metallofullerenes on the Number of Positions of Pyracyclene Bonding Motifs on the Cage".</p> <p>On 9/24/10 several faculty and students attended the GlaxoSmithKline Pharmaceuticals Company Symposium. The symposium included speakers from Yale University, California Institute of Technology and Colorado State University. Topics included the synthesis of new organic molecules which could be used medically, research on reproduction of natural existing organic compounds in the lab, and discussions on how to overcome obstacles of scientific research. Hamilton Dickson, an FMU Chemistry alumnus, also provided the FMU group with a facility tour.</p> <p>In October two faculty and eight students presented science demonstrations for Senior Citizens with the Florence County Parks and Recreation. Three demonstrations and one hands-on activity were</p> |

presented. Metal salts ( $\text{KCl}$ ,  $\text{CaCl}_2$ ,  $\text{Sr}(\text{NO}_3)_2$ ,  $\text{CuCl}_2$  and  $\text{NaCl}$ ) were used to give dramatic flame tests. "Elephant Toothpaste" was prepared and then its chemistry explained. The glowing pickle was demonstrated and a discussion about how electrolytes conduct electricity followed. For the hands-on activity, test tubes with a variety of household substances were analyzed using red cabbage juice as a pH indicator. The seniors were very interested in our undergraduate students and seemed to have a good time.

To celebrate the National Chemistry week theme, "Behind the Scenes with Chemistry", FBI Forensic DNA Examiner, Rhonda Craig was invited to talk about her career on 10/21/10. Ms. Craig spoke to the Biochemistry class and also presented a symposium open to the public. Ms. Craig also spoke one on one with many students about employment opportunities and internships.

On 10/22/10 (also in National Chemistry Week), the Student Affiliate hosted our first Chemistry Olympics at the University Center. Fun chemistry related games included Cork Ring/Ringstand Toss, Blindfolded Mouth Pipetting, Mole Scavenger Hunt, Wac-A-Mole, Speed Model Building, Pin the Functional Group on the Benzene Ring, and Periodic Table Twister. Prizes ranged from ACS chemistry week tattoos, chemistry bumper stickers, t-shirts, and stuffed moles for the winners

For Mole Day (10/23/10), a public message about the scientific mole was displayed on the campus electronic sign board on the intersection of Highway 76 and Francis Marion Road.

On February 1, 2011 a showing of "Madame Curie" was coordinated with the English department as part of the English Film Series on campus. This activity was to celebrate the 100 year anniversary of Curie's Nobel Prize and to highlight the achievements of women in science. The movie showed at two different times that day - 3:30 and 7:30 pm.

The FMU Chemistry Department hosted the South Carolina ACS Meeting on February 22, 2011. Environmental chemist, Dr. John Ferry, talked about his approach to teaching Environmental Chemistry at USC. His presentation was titled, "Environmental Chemistry in the Classroom: Context, First Principles and Case Studies."

On March 14<sup>th</sup> fourteen faculty and students were given a tour of the forensic labs of the State Law Enforcement Division. Again, this tour was made available by a former alumnus, Robert Sears.

On March 25<sup>th</sup>, ten faculty and students were given a tour of the Davis and Brown laboratory in Quinby, SC. Davis and Brown performs soil and water analyses. The majority of the tour was led by

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|  | <p>Scott Fields who is an FMU Chemistry alumnus.</p> <p>On April 2<sup>nd</sup>, the second annual Fred R. Clayton Alumni Symposium was held in the Lee Nursing Building. Four Alumni were invited as speakers: Kimberly Weaver Alexander – a physical science teacher at Hartsville Middle School, Mike Cook – Lab Director of the wastewater treatment facility in Florence, Dr. Leslie Lovelace - a Post-Doctoral Fellow and adjunct faculty at the University of South Carolina and Dr. Steve McCall – an Agricultural Research Chemist at BASF.</p> <p>On Wednesday, April 20<sup>th</sup>, several faculty and students attended the April meeting for the S.C. Section of the American Chemistry Society. The meeting was held at Claflin University in Orangeburg, SC. During this meeting, awards were given out by the S.C. Section of the ACS to outstanding chemistry majors from the ACS certified colleges and universities in South Carolina. For Francis Marion University, Jamell Brown received this award. Jamell’s academic achievements and biographic information were presented by Dr. Jones during the awards banquet. Also, during this meeting, research posters were presented by students from various colleges and universities in South Carolina. The meeting concluded with a presentation by the South Carolina Section Outstanding Chemist of the Year, Dr. Stephen L. Morgan, Professor of Chemistry at the University of South Carolina. Dr. Morgan presented on his research concerning textile fiber and fiber dye analysis using microspectroscopy.</p> |
| <p>Increase the opportunity for chemistry students to participate in undergraduate research</p>  | <p>During the summer of 2010 five students were able to continue undergraduate research projects with partial funding from Women and Minorities money. During the 2010-2011 academic year, four students participated in undergraduate research. In fact, one of our majors (Ashley van Laetham) won the campus undergraduate poster research award.</p>  |
| <p>Secretarial help is needed on the third floor.</p>  | <p>Due to budget constraints, the Chemistry Department continues to share a secretary with the Physics Department (first floor). This is not an ideal situation and will continue to be revisited as the budget improves.</p>   |
| <p>Examine and apply traditional and new teaching strategies, incorporating new technologies</p> | <p>POGIL (process oriented guided inquiry learning) was used for the trailer course in CHEM 201 during the spring semester of 2011. The format included students working in self-managed groups, submitting worksheets, homework assignments, quizzes and tests. This different instructional mode was chosen based on the large number of students taking the course for the second or third time. Since they had not been successful with the traditional lecture format, we attempted to try a different method of introducing the material. Although the students</p>   |

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|  | <p>were somewhat resistant to the new format, the course was generally successful.</p> <p>Several lab experiments were modified in the General and Organic lab programs. Further modifications will be examined for both programs.</p>   |
| Office and instructional computers need to be upgraded.  | Two faculty computers were updated this year.  |
| Publicity needs to be improved via local media and the University's Community Relations Office | <p>Dr. Jennifer Kelley and members of the SAACS promoted various departmental activities campus-wide and coordinated press releases with the Community Relations Office.</p> <p>Flyers announcing events were posted in the Leatherman Science Facility, McNair Science Building, campus housing and the Smith University Center. Communication was also accomplished via e-mail and announcements in class. Flyers were used to make students aware of the availability of the chemistry tutoring center and the hours of operation. Order forms for sweatshirts were distributed in the chemistry classes.</p> <p>Dr. Kelley developed a Facebook page (Francis Marion University American Chemical Society) to communicate about events, exchange digital photos, and interact with members. The Facebook page improved our web presence and improved awareness about the group's activities.</p> |
| Increase the participation of women and minorities in chemistry                                | <p>Drs. Leroy Peterson and Jennifer Kelly are mentoring student research projects utilizing funds from the Women and Minorities Grant.</p> <p>90 % of the student affiliate members are women or minorities. Women and minorities were actively involved in all activities of the Student Affiliate chapter, from social events, fundraisers, trips to professional meetings, and interactions with elementary and middle school students.</p>   |
| Continue general education assessment in CHEM 101  | The general education assessment was administered in fall 2010 students enrolled in CHEM 101. A series of multiple choice questions were developed using the experiment on the conversion of a carbonate to a chloride. Overall, the students showed, as indicated by the correctness of their responses, that they generally understood the scientific principles being questioned.   |

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| <p>Continue to be involved in science activities with elementary and middle school students</p> | <p>In December Dr. Kelley and two students went to North Vista Elementary to make borax Christmas ornaments with Mrs. Peterson's science class (10 students). Mrs. Peterson reported that the students enjoyed the experiment so much that teachers from other classes were coming by to see the ornaments and some of the students decided to alter variables in the process (such as concentration and temperature) as their science experiment for the science fair.</p> <p>Three FMU chemistry majors also made Christmas ornaments with the fourth grade students at Johnsonville Elementary School during their semester break. They went to five class rooms (around 100-120 students total). After a brief chemistry lecture describing the experiment, each student prepared an ornament. The teachers and students were very impressed with the FMU students and were very appreciative of their time and effort.</p> <p>On March 1<sup>st</sup>, two faculty and three students served as judges for the science fair at Johnakin Middle School. There were approximately 30 projects. They evaluated the projects, interviewed the students, and determined the winners of the various categories as part of the judging process.</p> <p>During Spring Break three FMU students volunteered at North Vista Elementary School helping 5<sup>th</sup> and 6<sup>th</sup> grade students prepare for a science fair. In doing so, they helped fifteen elementary students design poster boards, build up confidence when asked questions about their projects, and present their poster boards clearly. In addition to helping the students prepare for the science fair, they helped Mrs. Peterson clean and organize the science lab.</p> <p>Eight faculty and two students served as judges at the Sandhills Region IV Science Fair held at Francis Marion. The Student Affiliate also organized an Egg Hunt for the science fair participants (approximately 250 students). In addition the Student Affiliate provided the science fair registration fee and lunch money for the children from North Vista Elementary for the third year.</p> |
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