INDIANA UNIVERSITY KOKOMO

# Bachelor of Arts in Chemistry Degree Program Review Self Study Report

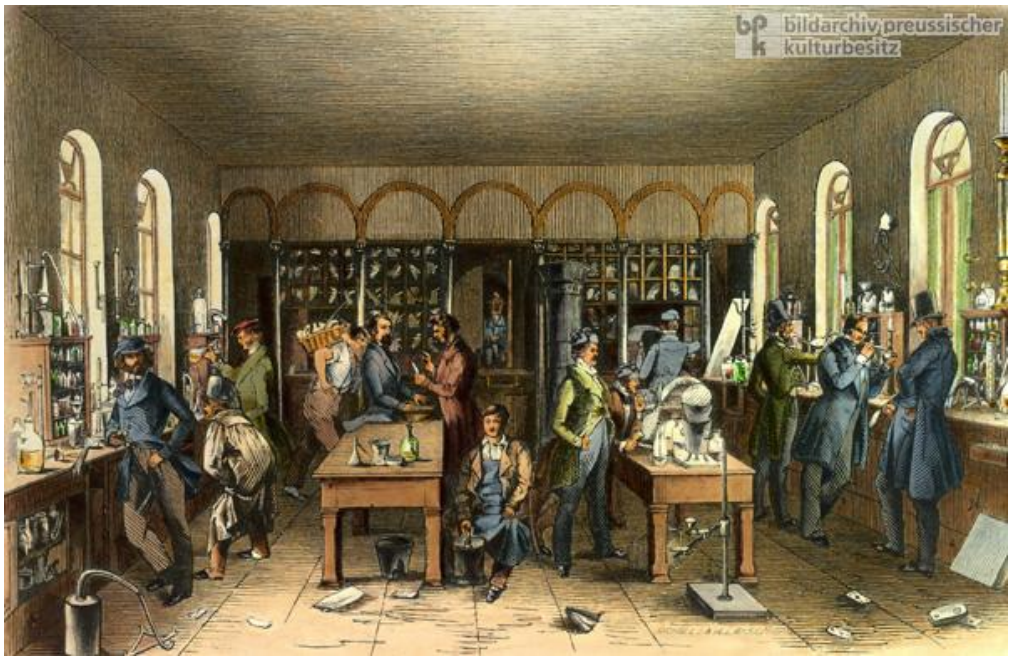
Department of Natural, Information, and Mathematical Sciences

2009-2010

## Preface

> **"**I would establish the conviction that Chemistry, as an independent science, offers one of the most powerful means towards the attainment of a higher mental cultivation; that the study of Chemistry is profitable, not only inasmuch as it promotes the material interests of mankind, but also because it furnishes us with insight into those wonders of creation which immediately surround us, and with which our existence, life, and development, are most closely connected."
>
> **Justice von Liebig** from
> *Familiar Letters on Chemistry 1789-1914*
> Volume 6, 1859

One hundred and fifty years ago, Justice von Liebig (1803 – 1873), a German chemist who made enormous foundational contributions to organic and agricultural chemistry, conceived of the laboratory-focused teaching method. That method remains the cornerstone of chemistry education today and is the model after which the Bachelor of Science in Chemistry degree at Indiana University Kokomo was modeled. What follows is a critical review of that degree and the plans the chemistry faculty have designed for future degree development.



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## I. Executive Summary

The Bachelor of Arts (B.A.) in Chemistry degree is housed in the Department of Natural, Information, and Mathematical Sciences (NIMS) in the School of Arts and Sciences at Indiana University Kokomo. The degree was first offered in 2003, with courses now taught by one tenured full professor, Dr. Kasem K. Kasem, one tenure-track assistant professor, Dr. Songwen Xie, one senior lecturer, Dr. Marcia L. Gillette, and one laboratory supervisor/instructor, Sara Deyo, M.S. Chemistry majors, as well as students taking chemistry courses prior to our instituting the chemistry degree, have been successful finding employment in chemistry-related positions both locally and out of state. Our tenure-track faculty are extremely active researchers and have engaged undergraduates in their scholarship throughout their employment in the department. These individuals and their students have published their research in a wide variety of refereed research journals and have presented their work locally, nationally, and internationally. All four faculty members are engaged in teaching a wide variety of majors and nonmajors courses and are active in community outreach, participating fully in the NIMS activities designed to bring students, adults, and families on campus to learn about science. The chemistry faculty have adopted a comprehensive assessment program and are strong in the belief that the major plays an important role in the overall mission of the campus.

Our biggest challenge is to find ways to increase the student demand for our advanced level courses and for our program, and to increase the "visibility" of the chemistry program in our seven-county service region. We are implementing a two-pronged approach to addressing this situation, one prong directed at our current and incoming students and the other prong directed at middle and high school students. For the benefit of our current IU Kokomo students, we have introduced a chemistry minor which is applicable to those in any major who are interested in adding a chemistry dimension to their other studies. The impetus for this minor came through a request from a business major who realized the value of a chemistry background as it applied to the work she planned to do. In addition, we have developed a biology-related track for our chemistry degree designed for those individuals who intend to focus primarily on biological applications of chemistry. To help our students recognize the wide application of chemistry to jobs in area industries we have written an NSF grant for funding to increase the number of internship opportunities with local businesses and industries for chemistry and other science majors. With respect to engaging and attracting students currently in middle school through high school, we have developed a summer science camp for middle school students and, for years, have been active in organizing the county science fair and providing support for student projects. We also hope to attract students from both groups (current students and middle school students) with a promotional video describing the post baccalaureate opportunities available to chemistry majors, including teaching high school chemistry. Developing this video will be part of a senior capstone project for IU Kokomo New Media majors.

Students majoring in chemistry at Indiana University Kokomo graduate with a strong, well-balanced academic experience which they can use as preparation for graduate school, as a background for completing the requirements for certification to teach high school chemistry, as a background for working in industry, and/or as a means of preparing for post-baccalaureate programs such as medical school, dental school, or law school. Our intent is to make this fact more evident and visible to our prospective and current students and to the community which Indiana University Kokomo serves so we can grow our program.

## II. Introduction and Review Process

The Bachelor of Arts (B.A.) in Chemistry degree in is housed in the department of Natural, Information, and Mathematical Sciences (NIMS) in the School of Arts and Sciences at Indiana University Kokomo. The chemistry degree centers on a traditional core of courses that includes organic, analytical, inorganic, physical chemistry, biochemistry and mathematics. But well rounded scientists also need backgrounds in other fields of knowledge, in the arts, the social sciences, and humanities. Thus, our chemistry curriculum also includes course requirements in subject areas such as history, English, sociology, psychology, foreign languages, mathematics, and information sciences. In addition to the extensive laboratory and classroom experiences offered through the chemistry program, research opportunities are also available for chemistry majors. Our chemistry faculty members are very active in photo-electrochemistry and organic chemistry. The curriculum for the major is outlined in Tables 1 and 2 below.

**Table 1. General Education Core Courses**

| Title | Course # | Credits |
|---|---|---|
| Elementary Composition I | ENG-W 131 | 3 |
| Elementary Composition II | ENG-W 132 | 3 |
| Public Speaking | SPCH-S 121 | 3 |
| Computing Tools | CSCI-C 100 | 1 |
| Foreign Language at the 200 level | Various | 6 |
| Mathematics | Various | 3 |
| Literature | Various | 3 |
| Performance | Various | 2 - 3 |
| Ethics | Various | 3 |
| Biological Science with Lab | BIOL-L 105 | 5 |
| Physical Science with Lab | Various | 5 |
| Non-Lab course in the sciences | Various | 3 |
| History of Western Civilization I | HIST-H 113 | 3 |
| History of Western Civilization II | HIST-H 114 | 3 |
| Social/Behavioral Science Electives (from 3 different disciplines) | Various | 9 |

**Table 2. B.A. in Chemistry Degree-Specific Courses**

| Title | Course # | Credits |
|---|---|---|
| Elementary Chemistry I | CHEM-C 105 | 3 |
| Elementary Chemistry I Lab | CHEM-C 125 | 2 |
| Elementary Chemistry II | CHEM-C 106 | 3 |
| Elementary Chemistry II Lab | CHEM-C 126 | 2 |
| Intro. to Quantitative Analytical Chemistry | CHEM-C 210 | 3 |
| Intro. to Quantitative Analytical Chemistry Lab | CHEM-C 211 | 2 |
| Analytical Chemistry | CHEM-C 310 | 3 |
| Analytical Chemistry Lab | CHEM-C 311 | 2 |
| Organic Chemistry I | CHEM-C 341 | 3 |
| Organic Chemistry Lab I | CHEM-C 343 | 2 |
| Organic Chemistry II | CHEM-C 342 | 3 |
| Organic Chemistry Lab II | CHEM-C 344 | 2 |
| Physical Chemistry I | CHEM-C 361 | 3 |
| Inorganic Chemistry * | CHEM-C 430 | 3 |
| Biochemistry * | CHEM-C 483 | 3 |
| Chemistry electives | Various | 3 - 6 |
| General Physics I | PHYS-P 201 | 5 |
| General Physics II | PHYS-P 202 | 5 |
| Introduction to Biology | BIOL-L 105 | 5 |
| Calculus I | MATH-M 215 | 5 |
| Calculus II | MATH-M 216 | 5 |
| Statistics | MATH-K 310 or PSY-K 300 | 3 |

* Optional, but strongly encouraged

Chemistry courses are taught by one tenured full professor, Dr. Kasem K. Kasem, one tenure-track assistant professor, Dr. Songwen Xie, one senior lecturer, Dr. Marcia L. Gillette, and one laboratory supervisor/instructor, Sara Deyo, M.S.. Abbreviated Curricula Vitae for these individuals appear as Appendix 1 at the end of this report. They all teach courses in the B.A. program as well as a wide variety of service courses for other science majors (including allied health majors) and for non-science majors.

The B.A. in Chemistry was officially established in 2003. Because this is the first program review for this degree, it covers the period since 2003. Data presented in this self study were gathered from a variety of sources including Indiana University's SIS (academic and administrative system), IU Kokomo's Registrar's Office, and IU Kokomo's Student Services.

## III. Review Criteria

### A. Program Role and Mission and Consistency with University Mission:

**1. Describe the ways in which the program advances the Campus' mission, vision, values, and strategic goals.**

IU Kokomo's Mission Statement is the following:

> The mission of Indiana University Kokomo, a regional campus of Indiana University, is to enhance the educational and professional attainment of the residents of north central Indiana by providing a wide range of bachelor's degrees, and a limited number of master's and associate degrees. Indiana University Kokomo is further dedicated to enhancing research, creative work, and other scholarly activity, promoting diversity, and strengthening the economic and cultural vitality of the region and the state through a variety of partnerships and programs.

IU Kokomo's Vision Statement is the following:

> Indiana University Kokomo aspires to become a regional institution of first choice recognized for providing critical opportunities for student success; acknowledged as a primary and engaged community resource; and valued as a campus where there are faculty, students, and professional staff active in research, creative work, and other scholarly activity.

The Department of Natural, Information, and Mathematical Sciences, which houses the B.A in Chemistry degree, is part of the IU Kokomo School of Arts and Sciences. The Mission Statement of the School of Arts and Sciences is the following:

> The School of Arts and Sciences at Indiana University Kokomo plays a central role in the mission of this comprehensive regional campus. It is the largest of the campus' six schools, and has been at the center of IU Kokomo's academic and intellectual life since the campus' inception. The school offers a liberal arts education that combines broad exposure to the insights and methods of the principal academic disciplines with focused study in one or more areas. It is also responsible for basic-skills courses in mathematics and oral and written communication, as well as the majority of the courses fulfilling system school and campus general-education requirements. Because of the richness and diversity of its majors and minors, strong undergraduate pre-professional programs, and numerous certificates, students have a variety of choices when selecting programs in the school. Although the content of courses has changed over the years, the primary mission of the faculty housed in the School of Arts and Sciences continues to be to foster the well-rounded development of students to enable them to take their place in a global world as effective citizens and life-long learners. Simultaneously, the school provides students with opportunities to develop skills that are required for the workplace and/or for advanced study. A liberal arts education emphasizes the ability to reason clearly, to extract the essential significance of large bodies of information, to apply general principles in new

contexts, to communicate effectively, and to be sensitive to human creativity and morality.

Finally, the Mission Statement of the Department of Natural, Information and Mathematical Sciences is the following:

> The mission of the Department of Natural, Information and Mathematical Sciences is to prepare students academically for entry into graduate programs and professional schools. Additionally, the department's mission is to provide a biology, chemistry, or mathematics baccalaureate education to enable students to be certified to teach these subjects at the secondary school level. Further, it is the unit's mission to prepare students for entry level employment opportunities in Mathematics, Information Systems, and the Biological and Physical Sciences, and to provide science, mathematics and information systems courses to fulfill the core and programmatic requirements of all other academic units on campus, including Purdue University programs.

The B.A. in Chemistry degree program is pivotal to each of the mission and vision statements referenced above. In the broadest context, this program is one of the wide variety of degree programs offered by the campus through which students are able to engage in both academic work and research. With respect to the School of Arts and Sciences, the chemistry major provides not only for students preparing for careers in industry, but for entrance into post-graduate programs in all areas of chemistry, environmental science, and medicine to name only a few. As importantly, the degree is the optimum preparation for those wishing to teach chemistry in middle and high schools throughout the state. Further, students interested in pursuing careers in areas such as patent law, forensic science, art restoration, pharmaceutical science, waste management, and managing chemistry-related businesses to name but a few, are well served with the background they gain through a chemistry major.

**2. List key relationships between the program and external constituencies such as collaborations, partnerships with regional, community and state organizations, and/or businesses.**

**Partnerships with Businesses and Organizations**

**NIMS Advisory Board:** The Department of Natural, Information, and Mathematical Sciences has established an Advisory Board which meets semiannually. This Board, convened and chaired by Dr. Christian Chauret, NIMS Department Chair, is composed of a veterinarian (and IU Kokomo graduate), a Chiropractor, representatives from Syndicate Sales, Haynes International, and Frontline Logic (an information technology business), a high school mathematics teacher (and IU Kokomo graduate), a high school biology/chemistry teacher, a dentist, and a medical doctor. The dinner meetings have featured a research presentation by a NIMS faculty member and substantive discussions between the board members and faculty regarding effective ways of both strengthening our partnership with the community and of eliciting additional interest in the department from students of our geographical service area. Examples of critical outcomes of these meetings have involved the exploration of chemistry internships at two of the businesses represented by Advisory Board members, and changes in the format of the Howard County Science Fair to bring greater exposure of the chemistry and other laboratory facilities and faculty to science fair participants and visitors.

**Internships:** In Summer 2009 two students worked as interns at Haynes International, producer of corrosion-resistant and high-temperature alloys. In addition, our Department Chair and a

chemistry faculty member have submitted a proposal for a National Science Foundation 09-569 Type 1A Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEM) grant to fund five internships for chemistry and other NIMS majors. We have letters of agreement from key personnel in four local businesses (Haynes International, Criterion Labs, LLC; Syndicate Sales (manufacturer of floral supplies and floral foam), and the Kokomo Wastewater Treatment Plant) who are willing to partner with our chemistry students for summer internships. Further, we have visited with the head of the Failure Laboratory at Delphi (producer of mobile electronics, transportation components, and systems technology) in an effort to establish such opportunities for our students. Because of the reorganization of General Motors and Delphi, the personnel there who can coordinate an internship program are not in place. However, we are confident that we will be establishing Delphi as a fifth partner business for internship purposes.

**American Chemical Society (ACS):** One faculty member has been a career consultant with ACS since 2008. ACS provides the online Career Consultant Program (CCP) free to its members. There are over 70 volunteer consultants who are available to assist other ACS members with various employment and career development matters including: résumé preparation, job search strategies, interviewing techniques, making a career transition, and salary negotiation techniques. The faculty member has conducted such consultations with two individuals via email and/or telephone. A second faculty member has worked with the ACS Examinations Institute to write the ACS exam covering the nonmajors' text *Chemistry in Context*.

**Editor of *CACS Communications* (ISBN 1939-4004), Chinese American Chemical Society (CACS):** One chemistry faculty member has been editor of profile column of this semiannual publication (2006-2010). The mission for this journal is to provide a platform for scientists with Chinese heritage around the world to learn, share, and collaborate in scientific fields. The profile column aims to improve visibility of successful Chinese chemical professionals working in USA, China, Europe and the rest of the world. The faculty member selects candidates to be profiled from nominations, works with two associates to contact and interview the candidates, and writes the profile articles. There are three profiles in each issue of the journal.

**Cairo International Conference on Energy & Environment (2007 and 2009):** One chemistry faculty member has been very active with this organization, moderating sessions on solar energy, solar electricity, and fuel cells in 2007 and 2009 at this biannual conference.

**Partnerships with high school teachers and students**

**Continuing Education Credit opportunities for high school teachers:** The continuing education credits required for public school teachers was the subject of lengthy discussion at one Advisory Board meeting. In recent years, local science and mathematics teachers have typically met their continuing education requirements by taking courses offered by Indiana Wesleyan University and other institutions. In effort to make our department's offerings more appealing, one chemistry faculty member offered a pilot program for a high school chemistry teacher from Lafayette who spent the summer developing several chemistry laboratory experiments to replace those currently in use in his curriculum. In addition to working out and writing up the procedural details for the new experiments, the teacher will present his work at the 2010 Hoosier Association of Science Teachers Inc. (HASTI) conference in early February, 2010.

**Taylor School Corporation Academies Committee:** One chemistry faculty member is a member of the Taylor Township Academies Committee, a group lead by the corporation superintendent that is examining ways of making their students more successful in post-high school programs. One strategy we have implemented to help Taylor High School chemistry and physics students better understand the challenges of high school to college transition is to bring these students to

campus. In Spring 2009 a group of sixty Taylor students spent a morning on our campus attending a freshman chemistry lecture and visiting the laboratories in chemistry, biology, and physics. The Taylor High School chemistry teacher (who completed his chemistry courses at IU Kokomo) has already expressed an interest in repeating the experience with a new group of students next year.

**Howard County Science Fair:** Beginning in 1999, one chemistry faculty member, teamed with several industry representatives from Delphi and Haynes International, have organized the Howard County Science Fair, an event showcasing the science projects completed by Howard County students in grades 5 through 12. This event brings forty or more professionals to the campus to aid in judging and ranking the student projects. All members of the IU Kokomo chemistry department serve annually as judges of the senior division (high school) projects. In 2009 the event also included organized programs for students and parents provided by members of the Department of Natural, Information, and Mathematical Sciences, which were very popular and will be repeated in the future.

**Indiana Academy of Science Talent Search:** Beginning in 2001, Indiana University Kokomo has been the host site for the Indiana Academy of Science Talent Search, which has been directed by one chemistry faculty member. This event brings twelve students from all over the state and their teachers/sponsors to campus for a two-day competition during which the students are individually interviewed and their posters are judged by five faculty members from Indiana colleges and universities (most recently from Ball State University, Rose-Hulman, Purdue University, and the University of Evansville). Among the awards given at this event are trips for the top two students and their teachers to the American Association for the Advancement of Science meeting the following February.

**Summer Science Camp:** In 2009 the NIMS department was awarded a two-year grant funded by the IU President's University Diversity Initiative for the establishment on campus of a Summer Science Camp (nicknamed *Science Rocks!*) for primarily seventh and eighth grade underrepresented minority students. Chemistry faculty members were closely involved in the summer camp activities. During the first summer (June 2009), 16 middle school students selected from underrepresented populations worked in groups on mini-projects in three different scientific areas (biology, chemistry, and physics) for 12 half-days. Some examples of experiments that were carried out in chemistry included determining the caloric content of peanut butter, jelly, and bread, and evaluating the protein content of some foods. In general, the chemistry portion of the camp went very well. The chemistry faculty are also considering how to improve these activities for future summer camps.

## B. External and Internal Demand

**1. Describe the external demand for graduates of the program.**

Indiana University Kokomo chemistry majors, and students who had concentrations in chemistry prior to the advent of our degree, have been very successful finding employment both in and around Howard County as well as in Michigan. Here are some examples. One student has started his own business in Kokomo using ion chromatography and other techniques to analyze electronics; several students have been employed in the chemistry laboratory and in the research center of Haynes International, doing control and research analysis for their corrosion-resistant alloys; one student who is one course removed from his chemistry degree is working at BioAnalytical Corporation in West Lafayette; a second student who is one course removed from her chemistry degree worked as a contract quality control chemist at Perrigo Pharmaceuticals in Michigan; and two of our chemistry graduates are working as chemists (one the chemistry

laboratory supervisor at Stork-Climax Research Services and the other as an environmental analysis specialist at Paragon Laboratories) in Michigan.

**2. What steps has the program implemented to attract enrollment from high school students and transfer students?**

**Internship potential:** Recruitment of chemistry majors has been a significant challenge for us since 2003 when we first offered the chemistry degree. Evidence points to several reasons for this, at least one of which we cannot control, but many that we can. What is out of our control is the hallmark of the field itself: Chemistry is both a theoretical and applied quantitative science, and a B.A. in Chemistry degree is, by definition, one that provides students with exposure to a broad range of subareas in the field, many of which presume a strong background in calculus and physics as well as in chemistry. Thus, the academic demands of the major are many and we know that the academically demanding nature of the required course work can be a deterrent for some students. However, a bigger issue for them is the apparent lack of visible local employment opportunities (besides teaching) for chemistry graduates. Although there are a relatively large number of professional opportunities for chemists in our seven country service region, these positions are not as visible to students as they might be. Kokomo is home to a diverse industrial base, for decades the largest employers have been Delco/Delphi Electronics and the Chrysler Transmission plants, companies rooted in the automotive industry, most of whose professional staffs are engineers. We know that the internship opportunities our students have had at Delphi and Haynes International (one at Delphi and three at Haynes International) have convinced the students in the program of the applicability of chemistry careers in the local area. Students who have had an industrial internship experience and go on to teach high school chemistry will also be highly valuable to local schools and their students. With internship experiences, these teachers will be well suited to help their students understand the applicability of their course material, and the roles trained chemists play in local businesses. Further, these well qualified teachers will be in an ideal position to promote chemistry research projects at the high school level, a research area that has been conspicuously missing from student projects in recent years.

**Secondary Education:** As is true throughout the country, Indiana has a critical shortage of high school teachers in all areas of math and science. In our service area, many high school chemistry teachers are both visible and highly active, not only in their own classrooms but in their involvement in science fairs, in state organizations such as the Hoosier Association of Science Teachers, Inc. (HASTI), and in Indiana Academy of Science programs for pre-college students. These teachers, some of whom are reaching retirement age, are outstanding role models and we are striving to develop a purposeful program whereby they actively recruit their own students to prepare to fill the retirement slots. The American Chemical Society (ACS), along with the National Science Teachers' Association (NSTA) co-chair the Science, Technology, Engineering, and Mathematics (STEM) Coalition, a group that is working with a large variety of academic, industrial, and philanthropic partners to improve science education in the United States. At the present time, it is more expedient for students wishing to teach high school chemistry to major in Secondary Education and take the required chemistry courses rather than to major in chemistry and take the required education courses. Currently, these two different approaches to preparation for high school teaching in all academic areas are being examined in Indiana. The State Superintendent of Education, Dr. Tony Bennett, has recommended a change in teacher preparation from a major in secondary education coupled with required chemistry courses and passage of the Chemistry Praxis examination to a major in chemistry coupled with requisite

education courses and passage of the Chemistry Praxis examination. We eagerly await the outcome of that discussion.

Regardless of the outcome however, we intend to work with the School of Education to encourage potential high school chemistry teachers to take the equivalent of a dual major so we can count them among our chemistry majors as well as education majors. One approach to this recruitment will be to engage with local chemistry teachers to make presentations both during our county science fair as well as to our NIMS Pre-Professional Club meetings as a means of expanding student awareness of the rewards and challenges of this profession. To further expose our students to the teaching profession, we will include increasing numbers of chemistry majors as assistants in our summer science camp activities.

**B.S. Degree:** Yet another factor involved in attracting majors over which we do have some control is the perception by some that earning a Bachelor of Science (B.S.) in Chemistry degree would be a more appropriate preparation for future employment or graduate studies than earning a B.A. in Chemistry degree. Although many would strongly disagree with this notion, we have made a proposal to the administration to provide students with the option of earning either degree. To this end we have submitted a proposed curriculum for a B.S. in Chemistry degree to the IU Kokomo administration (the proposal has not been approved yet). Details of this proposal appear in Appendix III.

**Forensic Chemistry:** The chemistry faculty met in October 2009 with Dr. Jay Siegel, Chair of the Department of Chemistry and Chemical Biology and Director of the Forensic and Investigative Science program at IUPUI. IUPUI offers both B.S. and M.S. degrees in forensic chemistry/science. Dr. Siegel suggested that IU Kokomo offer FIS 205 Concepts of Forensic Science I in the future as a means of engaging more students who might otherwise not be attracted to the sciences, especially chemistry. He added that this course could be a stepping stone to attracting more students to chemistry and that our marketing effort could also include the possibility that chemistry graduates could then move on to IUPUI to enroll in the M.S. in Forensic Science program. The chemistry faculty are exploring this possibility.

**Pre-Professional Tracks:** The intent of many of our science majors is to prepare for post baccalaureate programs in fields such as medicine, dentistry, pharmacy, and physical therapy, to name but a few, rather than to pursue a professional career in the science field per se. To date, these students have been 'automatically' guided to declare their majors in biology or biological and physical sciences rather than in chemistry. Although these two types of biology degrees are very appropriate avenues leading to post-graduate programs, we want to help students realize that they can also meet the prerequisites for these science-related fields while majoring in chemistry. To aid with this we have written a curriculum that meets the professional program needs and hope that the professional advisors will describe our program as an attractive alternative to the biology major. While combining the requirements for a chemistry major with the biology courses necessary to properly prepare a student to do well on examinations such as the Medical College Admission Test (MCAT) essentially removes the opportunity for the student to take elective courses of his/her choosing, the academic experiences provide the student with a very strong preparation for their post-Baccalaureate studies.

**Chemistry Minor:** Clearly, our goal is to increase the number of chemistry majors. However, we also realize that students in many disciplines can enhance their knowledge of chemistry and

marketability by majoring in directly or tangentially-related fields with a minor in chemistry. Thus, in the past year we designed and had approved a chemistry minor that can be taken by majors in any discipline. Interestingly, the impetus to create the chemistry minor came in response to a request from a business major. To earn a minor in chemistry, students must complete a minimum of twenty-one (21) credit hours in chemistry with a minimum grade of C in each course (students must take all the necessary prerequisites before enrolling in courses required for the minor). The specific course requirements are listed in Table 3.

**Table 3. Course Requirements for a Minor in Chemistry**

| **Required** | Course # | Credits |
|---|---|---|
| Elementary Chemistry I | CHEM-C 105 | 3 |
| Elementary Chemistry I Lab | CHEM-C 125 | 2 |
| Elementary Chemistry II | CHEM-C 106 | 3 |
| Elementary Chemistry II Lab | CHEM-C 126 | 2 |
| Organic Chemistry I | CHEM-C 341 | 3 |
| **Select one of the following two analytical chemistry courses** | | |
| Intro. to Quantitative Analytical Chemistry | CHEM-C 210 | 3 |
| Analytical Chemistry | CHEM-C 310 | 3 |
| **Select one of the following laboratory courses** | | |
| Intro. To Quantitative Analytical Chemistry Lab | CHEM-C 211 | 2 |
| Analytical Chemistry Lab | CHEM-C 311 | 2 |
| Organic Chemistry Lab II | CHEM-C 344 | 3 |
| **Select one (or more) courses from this list to complete the 21-credit hour minimum requirement** | | |
| Organic chemistry II: Lecture | CHEM-C 342 | 3 |
| Organic Chemistry II: Laboratory | CHEM-C 344 | 2 |
| Biochemistry * | CHEM-C 483 | 3 |
| Green Chemistry & Sustainability Sciences | CHEM-C 351 | 3 |
| Physical Chemistry I | CHEM-C 361 | 3 |
| Chemical Information Sources and Services | CHEM-C 400 | 1 |
| Inorganic Chemistry | CHEM-C 430 | 3 |
| Organic Spectroscopy | CHEM-C 443 | 3 |

**3. Describe internal demand for courses in the major using institutional data**

Table 4 shows the enrollment in the B.A. in Chemistry degree program since Fall 2005. The enrollment has been between 9 and 12 students with the exception of Fall 2009 in which it decreased to five students. Table 5 below is an anonymous list of all nine chemistry B.A. graduates from IU Kokomo. All of them are doing graduate studies in chemistry, teaching high school chemistry, or are employed as chemists in the industry.

**Table 4. Internal Demand (new chemistry majors on campus per semester since Fall 2005).**

| | Fall 2005 | Spring 2006 | Fall 2006 | Spring 2007 | Fall 2007 | Spring 2008 | Fall 2008 | Spring 2009 | Fall 2009 |
|---|---|---|---|---|---|---|---|---|---|
| **Internal transfers to major** | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| **New to campus** | 0 | 1 | 6 | 0 | 3 | 2 | 2 | 0 | 1 |
| **Total number of new Chemistry B.A. majors** | 0 | 1 | 7 | 1 | 3 | 3 | 3 | 0 | 1 |
| **Continuing Chemistry Majors** | 12 | 8 | 5 | 10 | 8 | 6 | 6 | 9 | 4 |
| **Total number of chemistry majors** | 12 | 9 | 12 | 11 | 11 | 9 | 9 | 9 | 5 |

**Table 5. Number of Chemistry Graduates Since 2003 and Their Graduation Dates.**

| Student | Degree | Major | Graduation Date |
|---|---|---|---|
| 1 | Bachelor of Arts | Chemistry | June 2003 |
| 2 | Bachelor of Arts | Chemistry | May 2004 |
| 3 | Bachelor of Arts | Chemistry | Fall 2005 |
| 4 | Bachelor of Arts | Chemistry | May 2006 |
| 5 | Bachelor of Arts | Chemistry | May 2006 |
| 6 | Bachelor of Arts | Chemistry | Summer 2006 |
| 7 | Bachelor of Arts | Chemistry | Summer 2006 |
| 8 | Bachelor of Arts | Chemistry | May 2009 |
| 9 | Bachelor of Arts | Chemistry | Summer 2009 |

**4. How has the program addressed increased demand?**

Demand for our program is a problem we need to address, as previously discussed. We need to make the opportunities better known to potential students and we need to increase the "visibility" of the chemistry program in the region. The summer science camp for middle school students, coupled with an increased number of internship opportunities and department sponsored programs associated with the local science fair will help to increase an appreciation of the value of a chemistry degree in our community and service region. Further, we hope that more students wanting to teach middle/high school chemistry will be directed to major in chemistry.

**5. What problems have been encountered in meeting demand?**

None.

## C. Productivity

**1. List grants and contracts received by the program in the last three years and indicate how these resources have affected program productivity and efficiency.**

Chemistry faculty members have had success obtaining both internal and external funding for a variety of activities (Table 6). The total amount of funding generated since 2003 is over $ 35,000.

**Table 6. Grants and Contracts Received by the Program.**

| Fiscal Year | Type of Resource | Approximate Dollar Amount |
|---|---|---|
| **2003** | URSI | $ 1,000 |
| **2004** | URSI | $ 1,000 |
| **2005** | URSI | $ 1,000 |
| **2006** | Grants-in-aid of Faculty Research, Indiana University Kokomo, 2006-2008 | $ 4,000 |
| | URSI | $ 1,000 |
| **2007** | Grants-in-aid of Faculty Research, Indiana University Kokomo, 2007-2009 | $ 4,000 |
| | URSI | $ 2,000 |
| | Senior Research Grant, Indiana Academy of Science, 2007-2008 | $ 3,000 |
| | Overseas Conference Fund, Office of International Programs, IU 2007 | $ 700 |
| | ACS Division of Organic Chemistry Faculty Travel Award for Faculty at Undergraduate Institutions for travel to the ACS National Meeting in Chicago | $ 600 |
| **2008** | Summer Faculty Fellowship, Indiana University Kokomo | $ 6,000 |
| | URSI | $ 2,000 |
| | The Dorothy and Moses Passer Education Fund, Division of Chemical Education, American Chemical Society | $ 700 |
| | Sigma Xi Grants-in-Aid of Research (GIAR) program for a student | $ 1,000 |
| | Student travel award from American Chemical Society Women Chemist Committee | $ 750 |
| | Travel support from Undergraduate Research Center, IU Kokomo | $ 750 |
| **2009** | Grants-in-aid of Faculty Research, Indiana University Kokomo, 2009-2010 | $ 4,000 |
| | URSI | $ 1,000 |
| | Student travel support from Center for Research and Creative Activity, IU Kokomo | $ 650 |

**2. List other financial resources generated by the program such as donations, externally funded programs, and conference earnings. Indicate how these resources have enhanced productivity, and efficiency.**

One chemistry faculty member was a co-applicant on the grant proposal to establish the Science Summer Camp in 2009 (Table 7) and played a significant role in its development.

**Table7. Other financial resources generated by the chemistry program.**

| Fiscal Year | Type of Resource | Approximate Dollar Amount |
|---|---|---|
| **2003** | | |
| **2004** | | |
| **2005** | | |
| **2006** | | |
| **2007** | | |
| **2008** | | |
| **2009** | IU President Diversity Initiative (Science Summer Camp in which a chemistry faculty was a co-applicant) | $20,000 (approximate amount for the science camp section for 2009-2010) |

**3. List in the table below the last three year's data on the program's fall to fall retention rate, graduate rate, and number of degrees awarded, and classes cancelled due to low enrollment and/or with an enrollment below ten.**

**Table8. Four-Year Enrollment Data.**

| School Year | Fall to fall retention rate | Number of cancelled classes | Number of graduates |
|---|---|---|---|
| **2005-06** | 62.5% | 0 | 5 |
| **2006-07** | 83.3% | 1 | 0 |
| **2007-08** | 33.3% | 1 | 0 |
| **2008-09** | 54.5% | 2 | 2 |

**Table 9. 200-, 300- and 400-Level Chemistry Course Enrollments. Table 9A, Non-Chemistry Majors; Table 9B Chemistry Majors (course credit hours are in brackets).**

### A. Non-Chemistry Majors

| | C 210 | C 211 | C 310 | C 311 | C 318 | C 341 | C 342 | C 343 | C 344 | C 351 | C 361 | C 390 | C 400 | C 409 | C 430 | C 443 | C 483 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fall 2003** | 2 (6) | 2 (6) | | | | 7 (21) | | 7 (14) | | | | | | | | | | **15 (47)** |
| **Spring 2004** | | | 2 (3) | 1 (2) | | | 4 (12) | | 3 (6) | | | 18 (54) | | | | | 12 (36) | **40 (113)** |
| **Fall 2004** | 1 (6) | 1 (6) | | | | 16 (48) | | 14 28) | | | 2 (6) | | | | | | | **34 (94)** |
| **Spring 2005** | | | | | | | 9 (27) | | 9 (18) | | | | | 1 (3) | | | | **19 (48)** |
| **Fall 2005** | | | | | 2 (6) | 20 (60) | | 17 (34) | | | | | | | | | | **39 (100)** |
| **Spring 2006** | | | 1 (3) | | | | 11 (33) | | 11 (22) | | | 11 (33) | | | | | 12 (36) | **46 (127)** |
| **Fall 2006** | 3 (9) | 3 (6) | | | | 15 (45) | | 13 (26) | | | 4 (12) | | | | | | | **38 (98)** |
| **Spring 2007** | | | | | | | 6 (18) | | 6 (12) | | | | | | | | 3 (9) | **9 (39)** |
| **Fall 2007** | 1 (3) | 1 (2) | | | | 15 (45) | | 15 (30) | | | | | | | | | 1 (3) | **33 (83)** |
| **Spring 2008** | | | 2 (6) | 1 (2) | | | 10 (30) | | 9 (18) | | | 24 (72) | | 1 (3) | | | 9 (27) | **56 (158)** |
| **Fall 2008** | 4 (12) | 3 (6) | | | | 12 (36) | | 10 (20) | | | 3 (9) | 30 (90) | | 1 (9) | | | | **63 (182)** |
| **Spring 2009** | | | 6 (18) | 5 (10) | | | 9 (27) | | 9 (18) | 2 (6) | | 60 (180) | | | | | | **91 (259)** |
| **Fall 2009** | 4 (12) | 1 (2) | | | | 11 (33) | 10 (20) | | | | | | | | 5 (15) | | | **31 (82)** |

**B. Chemistry Majors Only**

| | C 210 | C 211 | C 310 | C 311 | C 341 | C 342 | C 343 | C 344 | C 351 | C 361 | C 390 | C 400 | C 409 | C 430 | C 443 | C 483 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fall 2003** | 4 (12) | 4 (8) | | | | | | | | | | | | 4 (12) | | | **12 (32)** |
| **Spring 2004** | | | 4 (12) | 4 (8) | | 1 (3) | | 1 (2) | | | 3 (6) | | | | | 4 (12) | **17 (43)** |
| **Fall 2004** | 4 (12) | 4 (8) | | | 3 (9) | | 3 (6) | | | 4 (12) | | | 1 (3) | | | | **19 (50)** |
| **Spring 2005** | | | 3 (9) | 3 (6) | | 4 (12) | | 3 (6) | | | | | 2 (6) | | | | **15 (37)** |
| **Fall 2005** | 3 (9) | 2 (6) | | | 1 (3) | | 2 (4) | | | | | | | 6 (18) | | | **14 (40)** |
| **Spring 2006** | | | 1 (3) | 1 (2) | | 2 (6) | | 3 (6) | | 1 (3) | | | | | | | **8 (20)** |
| **Fall 2006** | | | | | 3 (9) | | 3 (6) | | 1 (3) | 3 (3) | | | 1 (3) | | | 5 (15) | **16 (39)** |
| **Spring 2007** | | | | | | 3 (9) | | 3 (6) | | | | | | | | | **6 (15)** |
| **Fall 2007** | 5 (15) | 5 (10) | | | 1 (3) | | 1 (2) | | 1 (3) | | | | | 3 (3) | | | **16 (36)** |
| **Spring 2008** | | | 4 (12) | 4 (8) | | 1 (3) | | | | | | | | | | 1 (3) | **10 (26)** |
| **Fall 2008** | 1 (3) | 1 (2) | | | 1 (3) | | 1 (2) | | | 1 (3) | | | | | | | **5 (13)** |
| **Spring 2009** | | | 1 (3) | 1 (2) | | 2 (3) | | 2 (2) | 2 (3) | | | | 1 (3) | | | 2 (3) | **11 (19)** |
| **Fall 2009** | 1 (3) | 1 (2) | | | 1 (3) | 1 (2) | | | | | | | | 1 (3) | | | **5 (13)** |

**Table 10. Enrollment in 100-Level Chemistry Courses for Both Chemistry Majors and Non-Chemistry Majors (course credit hours are in brackets).**

| | C100 | C120 | C101 | C121 | C102 | C122 | C105/ 125 | C106/ 126 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Fall 2003** | 43 (129) | 14 (42) | 31 (92) | 27 (54) | | | 27 (135) | | **142 (452)** |
| **Spring 2004** | 56 (168) | 12 (24) | | | 5 (15) | 4 (12) | | 20 (125) | **97 (344)** |
| **Fall 2004** | 49 (147) | 5 (10) | 57 (171) | 46 (138) | | | 44 (220) | | **201 (686)** |
| **Spring 2005** | 52 (156) | 17 (54) | 30 (90) | 23 (69) | 8 (16) | 5 (10) | | 31 (155) | **166 (550)** |
| **Summer 2005** | 29 (87) | | | | | | | | **29 (87)** |
| **Fall 2005** | 58 (174) | 16 (32) | 43 (129) | 32 (64) | | | 51 (125) | | **200 (524)** |
| **Spring 2006** | 65 (195) | 16 (32) | 32 (160) | 27 (54) | 6 (18) | 5 (10) | | 23 (115) | **174 (584)** |
| **Summer 2006** | 24 (72) | 16 (32) | | | | | | | **40 (104)** |
| **Fall 2006** | 37 (111) | 8 (16) | 34 (102) | 25 (50) | | | 49 (245) | | **153 (524)** |
| **Spring 2007** | 42 (126) | 25 (50) | 23 (69) | 16 (32) | 3 (9) | 2 (4) | | 21 (105) | **132 (395)** |
| **Fall 2007** | 23 (69) | 16 (32) | 42 (210) | 35 (70) | | | 45 (225) | | **161 (606)** |
| **Spring 2008** | 39 (117) | 16 (32) | 25 (75) | 22 (44) | 4 (12) | 4 (8) | | 17 (85) | **127 (373)** |
| **Summer 2008** | 30 (90) | 11 (22) | | | | | | | **41 (112)** |
| **Fall 2008** | 30 (90) | 17 (34) | 35 (105) | 31 (93) | | | 44 (220) | | **157 (542)** |
| **Spring 2009** | 35 (105) | 17 (34) | 35 (105) | 25 (75) | 7 (21) | 6 (12) | | 27 (135) | **152 (487)** |
| **Fall 2009** | 55 (165) | 16 (32) | 52 (156) | 19 (57) | | | 56 (280) | | **198 (690)** |

The enrollment per semester in 200-, 300-, and 400-level classes for chemistry majors and non-chemistry majors is shown in Tables 9A and 9B. The enrollment in 100-level classes for all majors is shown in Table 10. In both tables, the credits hours generated are indicated in brackets.

Table 11 is a summation of the FTE per semester, total credits generated per semester, and credit hours per FTE. Prior to Fall 2005, organic chemistry was taught by Dr. Phil Haffley who had an administrative appointment as an assistant Vice Chancellor. Dr. Haffley only taught organic chemistry (lab and lecture) and thus the FTE was lower. When he retired, Dr. Songwen Xie was hired (beginning Fall 2005) as a tenure track assistant professor of organic chemistry. She also taught a variety of lower level and upper level courses (thus the chemistry FTE increased beginning Fall 2005). The low FTE (2.4) in Spring 2007 is due to Dr. Kasem's sabbatical leave for that term. The fact that Dr. Kasem did not teach that semester is probably reflected as well in the relatively low credit hours per semester in Spring 2007.

**Table 11. Faculty Productivity Based on Total Major and Non-Major Credit Hours**

| | Fall 2003 | Spring 2004 | Fall 2004 | Spring 2005 | Fall 2005 | Spring 2006 | Fall 2006 | Spring 2007 | Fall 2007 | Spring 2008 | Fall 2008 | Spring 2009 | Fall 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Credit Hours (from Tables 7 & 8)** | 531 | 500 | 830 | 664 | 664 | 731 | 661 | 449 | 725 | 557 | 737 | 765 | 785 |
| **FTE** | 2.87 | 2.87 | 2.87 | 2.87 | 3.12 | 3.12 | 3.12 | 2.40 | 3.12 | 3.12 | 3.12 | 3.12 | 3.12 |
| **Credit hours per FTE** | **187** | **174** | **289** | **221** | **213** | **234** | **212** | **187** | **232** | **179** | **236** | **245** | **252** |

According to the IU 2007-2008 Fact Book, the IU Kokomo "Student Credit Hours per Full-Time Academic Appointment" ranged from 281 to 313 for the 2003-04 to 2007-08 period. During the same period, the student credit hours per full-time academic appointment in chemistry was a bit lower than this average mostly due to relatively low enrollment in the upper level chemistry courses. We are encouraged, however, that enrollment in chemistry courses has increased since Fall 2008 (See Table 11) and that enrollment in CHEM-C 105/125 was at a record high of 56 (Table 9). We had to open a fourth lab section of CHEM-C 125 for the first time this year.

**Provide information relating to other areas in which the major has contributed to Campus-wide initiatives in the areas of learning, engagement, diversity, and others not already reported in a previous section of this report. These might include but are not limited to involvement in freshmen learning communities, Campus-community partnerships and collaborations, and Campus diversity initiatives. Please provide specifics regarding the number of individuals involved in each initiative, the duration of the involvement, as well as the impact of the initiative on the Campus.**

**SCIENCE ROCKS Summer Exploratory Science Camp:** IU Kokomo received $76,000.00 in funding from the IU President's University Diversity Initiative to fund two, two-year programs on our campus, one of which is a Summer Exploratory Science camp for middle school minority students. The target population was students enrolled in Howard County schools with more than 10% minority populations. In summer 2009 the Summer Exploratory Science Camp introduced sixteen middle school minority students to three basic scientific fields: biology, chemistry, and physics. These students attended 12 half-day sessions of 3.5 hours at IU Kokomo in June. The students took a brief pre-test on the first day which consisted of questions addressing their general knowledge about the scientific method, theories, hypotheses, etc., which was followed by a general discussion of the scientific process and a field trip to the Kokomo Wastewater Treatment plant, where all three aspects of science they would be studying are illustrated. On the following nine days the students worked for three half-day periods in each science area, where they did several hands-on mini-projects. The students spent the last two days of the program making posters and presenting their posters to their parents and guests. The proposal was written to invite the same group of students to spend the second summer (2010) carrying out a small, hypothesis-driven scientific project that can be accomplished over a two-week period with the assistance of faculty members and student teaching assistants. The second year experience will culminate in a small science fair where students will show and explain their projects to parents and guests. This two-year program, approved by IU President Michael McRobbie, falls in line with IU Kokomo's strategic plan that calls for the development and implementation of activities and programs designed to increase and enhance student diversity on campus. IU Kokomo's initiative is one of 12 diversity programs university-wide to receive funding.

With the assistance of one faculty member, the chemistry laboratory supervisor, and an IU Kokomo undergraduate teaching assistant, on days 2-4 of the program the students worked in the chemistry laboratories doing various kinds of analyses and characterization tests on the components of a peanut butter/jelly sandwich and glass of milk. Their experiences included determining the Caloric content of the milk, bread, jam, and peanut butter using a Parr bomb calorimeter, estimating the protein content of these components with a Kjeldahl analysis, extracting and determining the extent of unsaturation of the fat from milk, and performing a variety of tests to indicate the presence of carbohydrates (especially lactose) in the milk. Prior to beginning their laboratory work, the students decorated safety goggles and lab coats which they wore while they were working in the lab. The faculty member and chemistry laboratory instructor developed a laboratory manual containing instructions for the tests and experiments the students carried out.

Based on the student evaluations as well as our own positive impressions, we are seeking external funding so we can engage a new cohort of students, this time sixth and seventh graders, in the program next summer. For this purpose we are exploring the possibility of an American Honda Foundation L0120a grant to fund the first year of the two-year problem. We have contacted the superintendents of the local school corporations to solicit some financial support, and will apply to the Howard County Community Foundation for additional funding. Further, as a result of our experiences with the students this year, we will likely change the scenario the students will tackle next year to incorporate more problem-solving than was part of the peanut butter/jelly/milk analysis scenario.


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## D. Program Quality

**Describe activities of the program that lead to high program quality and provide documentation of how that quality is measured.**

**1. Provide evidence of the students' successful achievement of the program's learning outcomes.**

The detailed Bachelor of Arts Degree in Chemistry assessment plan appears in Appendix IV.

With respect to the pivotal first year chemistry course (CHEM-C 105/CHEM-C 106) the chemistry faculty members firmly believe that our two-semester freshman chemistry course is an important foundation upon which our majors (and all students taking the classes) will build their understanding of higher level courses in both chemistry and other areas of science. Because this course sequence may be taught by a variety of faculty members, we felt it was critical to establish what we term a comprehensive 'department final exam' for each semester, which the students would complete as a significant part of their final course grade. While the purpose of the exam is to assess students' mastery of what the department deems the critical concepts taught in the two semesters, we also use student performance on these exams to help indicate areas where we need to be more effective conveying the concepts and skills. As a result, we have done item analyses on these exams to pick out areas where the students seem less strong and use this analysis to promote changes in our teaching in those areas. Further, we are interested to see the correlation between the students' final course grade and their performance on the department final exam for a particular semester.

Because chemistry is an experimental science, establishing strong laboratory skills for our students is also pivotal to their success in future courses. As a result, Sara Deyo gives students in CHEM-C 126 and CHEM-C 126 both midterm and final examinations to test their ability to process and apply data. As is true in the case of the C105 and C106 final examinations, our benchmark is that 70% of those students who pass the courses will also pass the department examination. These correlations appear in the Appendix IV of this program review.

Moreover, Dr. Xie administers the American Chemical Society Organic Chemistry Examination written through the ACS Examinations Institute to her CHEM-C 341 and CHEM-C 342 (Organic Chemistry) students each year, and Dr. Gillette gives a comprehensive final examination in the laboratory portion of the first semester Analytical Chemistry course (CHEM-C 211). In all these cases, the outcome of these examinations counts heavily into the students' semester grades.

In addition to conducting specific assessment of the learning outcomes in the courses as described above, the chemistry faculty members are also interested in an overall learning assessment of the graduating seniors. Initially, we considered administering the Educational Testing Service Major Field Test in Chemistry to our graduating chemistry majors. Since formulating that plan we have had an opportunity to examine the newly available Diagnostic of Undergraduate Chemistry Knowledge (DUCK) examination, an interdisciplinary examination within the field of chemistry created by the American Chemical Society Examinations Institute. According to an article by Tom Holme appearing in the Spring 2009 "CHED Newsletter" (p.9): "The committee who developed this exam essentially began from the "Big Ideas" that were enumerated in the Exploring the Molecular Vision (EMV) conference of the ACS Society Committee on Chemical Education, and built scenarios that generally include data interpretation and query student knowledge in more than one of the traditional sub-disciplines. We ended up with 15 scenarios that support four exam items each for a total of 60 items on the exam. The Institute is also working from the EMV conference in our efforts to map the undergraduate content curriculum. The resulting map will be used to provide a form of criterion referencing of ACS Exams, in addition to the usual norm-referencing we have always done. Thus, the DUCK will be able to play a key role in programmatic assessment for departments who use ACS Exams."

We recognize that assessment should not be limited to student performance on standardized examinations. Therefore, we also review our graduates' Grade Point Average (GPA) with attention to their overall Science/Mathematics GPA and laboratory course GPA; their performance on science portions of nationally-normed post-graduate examinations (for example, the GRE and MCAT); their involvement in student conference presentations and publications; and their employment, placement, and graduate school acceptances as a measure of their preparedness.

Admittedly, it has been difficult for us to reasonably assess our assessment strategies and to achieve our benchmark of a 70% success rate because the small number of chemistry majors in most courses makes it difficult to use data for one academic year. For example, there may only be 2 or 3 chemistry majors in some classes and yearly aggregate data would not be meaningful. We expect this situation to improve as we implement our strategies to attract more chemistry majors.

**2. Provide outcome information on graduates as available, in particular, employment and enrollment in graduate programs. Information on exit exams, licensure, and other tests and exams should also be provided, especially when comparative results are available.**

Since 2003, IU Kokomo has graduated nine students with a B.A. in chemistry (Table 12). We have information about eight of these graduates and they all work (or still study) in chemistry or in a

chemistry-related field. The success of these students clearly demonstrates that students who go through this rigorous program will be very successful at finding employment or at moving on to graduate studies in chemistry. We are especially proud that one chemistry graduate from our program is now working as a chemistry high school teacher in Howard County, thus fulfilling an important need in the K-12 education system.

**Table 12. Graduation Dates and Current Occupations of B.A. in Chemistry Graduates, 2003 to present.**

| Student | Degree | Major | Graduation Date | Present Occupation |
|---|---|---|---|---|
| A | Bachelor of Arts | Chemistry | June 2003 | Project manager, Bioanalytical |
| B | Bachelor of Arts | Chemistry | May 2004 | Quality Lab, POET Biorefining (Ethanol) Plant, Alexandria, IN |
| C | Bachelor of Arts | Chemistry | Fall 2005 | Chemistry Teacher Taylor School, Howard County, IN |
| D | Bachelor of Arts | Chemistry | May 2006 | Chemistry Laboratory Supervisor, Stork-Climax Research Services, Wixom, MI |
| E | Bachelor of Arts | Chemistry | May 2006 | Environmental Analysis Department, Paragon Laboratories, Livonia, MI |
| F | Bachelor of Arts | Chemistry | Summer 2006 | Elli Lily, Indianapolis |
| G | Bachelor of Arts | Chemistry | Summer 2006 | Graduate Studies in Chemistry at IUPUI |
| H | Bachelor of Arts | Chemistry | May 2009 | Purdue Graduate Studies in Chemistry |
| I | Bachelor of Arts | Chemistry | Summer 2009 | IUPUI Certificate Studies in Chemistry |

**3. Discuss the benefits, impact, and importance of accreditation where appropriate.**

The approval or certification obtained by many college and university chemistry departments comes through the American Chemical Society (ACS). According to page 4 of the *Undergraduate Professional Education in Chemistry: ACS Guidelines and Evaluation Procedures for Bachelors Degree Programs"* published in Spring, 2008, "There must be at least four full-time, permanent faculty members wholly committed to the chemistry program. Most vigorous and sustainable programs have a larger number." Because our program is staffed by two tenure-track faculty, one full-time chemistry laboratory instructor, and one full-time senior lecturer in chemistry, the IU Kokomo chemistry program does not have sufficient staff to qualify for ACS certification.

**4. What steps has the program taken to develop pedagogical innovation and forward-looking curricula?**

- The chemistry faculty members have submitted a proposal in March, 2007 for a B.S. in Chemistry degree (the proposal has not been approved yet).

- The chemistry faculty members have developed and had approved a program for students wanting to minor in chemistry.
- The chemistry faculty members have devised an advising guide for pre-med students wanting to major in chemistry.
- Faculty have participated in Faculty Learning Communities directed to course planning, small group learning, peer review of teaching, and other pedagogically-related issues. Many of these experiences were provided through the IU Kokomo Center for Teaching, Learning, and Assessment. Some were sponsored by the Faculty Colloquium on Excellence in Teaching (FACET).
- Dr. Xie brought the following speakers to campus to present their research to our students:
  - Dr. Randy J. Arnold, Indiana University Bloomington, "Proteomics at Indiana University", November 7, 2006.
  - Dr. Cal Y. Meyers, Southern Illinois University Carbondale, "Non-steroidal compounds that reduce prostate-cancer cell proliferation with little or no feminizing effect", April 10, 2007.
  - Dr. Daniel Becker, Loyola University Chicago, "Pharmaceutical Drug Design and Discovery", October 9, 2007.
  - Dr. Shenshen Cai, Mylan Laboratory, Inc. (PA), "Drug Delivery – The Art of Transporting Drugs to Our Body", November 26, 2007. This speaker's visit was supported by funding from the American Democracy Project.
  - Dr. David Smithrud, University of Cincinnati, "From Protein Mimetics to Cellular Transport Agents", March 31, 2008.

**5. Provide evidence of advising effectiveness.**

Chemistry courses and the chemistry degree program are highly structured with regard to knowledge prerequisites for advanced courses. Students advised by the NIMS faculty were prepared for the courses for which they registered. Within the past year the academic advising program at IU Kokomo has been revised and now, many newly matriculated students meet with professional advisors to discuss their academic needs and determine their class schedules. Some of these new students also meet with NIMS faculty members to explore in more depth their interests and degree plans. Since the introduction of the B.S. in Secondary Education, prospective high school chemistry teachers have been admitted into the Division of Education. Unfortunately, some have become frustrated with the education curriculum and have rethought their career choice.

**6. Describe specific efforts aimed at student success and retention; if possible, include the numbers of students, faculty, and staff involved in these initiatives, and provide evidence of the effects of these activities quantitatively and qualitatively.**

One chemistry faculty member regularly teaches CHEM-C 483 (Biological Chemistry) as an unpaid overload (independent study course) in order to facilitate student progress toward graduation (Table 12). Chemistry faculty members are also strongly committed to undergraduate research and regularly teach CHEM-C 409 (Chemical Research) as an unpaid overload (Table 13). This shows a strong commitment to the degree program and to student success.

**Table 13. Chemistry Faculty Teaching Overloads Since 2003.**

| Faculty Member | Semester | Course | Number of Students |
|---|---|---|---|
| Sara Deyo | Spring 2003 | CHEM-C 483 | 1 |
| Sara Deyo | Summer 2006 | CHEM-C 483 | 4 |
| Sara Deyo | Spring 2007 | CHEM-C 483 | 3 |
| Sara Deyo | Summer 2007 | CHEM-C 483 | 2 |
| Sara Deyo | Summer 2008 | CHEM-C 483 | 2 |
| Philip Haffley | Spring 2005 | CHEM- C 409 | 2 |
| Kasem Kasem | Fall 2004 | CHEM-C 409 | 1 |
| Kasem Kasem | Spring 2005 | CHEM- C 409 | 1 |
| Kasem Kasem | Fall 2006 | CHEM- C 409 | 1 |
| Kasem Kasem | Summer 2007 | CHEM-C 409 | 1 |
| Kasem Kasem | Fall 2008 | CHEM-C 409 | 1 |
| Kasem Kasem | Spring 2009 | CHEM-C 409 | 1 |
| Kasem Kasem | Fall 2009 | CHEM-C 409 | 1 |
| Songwen Xie | Spring 2008 | CHEM- C 409 | 1 |

One secretary in the department is specifically assigned to the chemistry and biology (biological and physical sciences) programs. In addition to working with mathematics faculty on a day-to-day basis, she performs the following important tasks related to student success:

- Contacts students every semester prior to registration period to remind them to make an advising appointment.
- Arranges advising appointments and files student dossiers.
- Contacts students during the registration period to follow up with them and remind them to register.
- Processes student evaluations of teaching for the entire department.

**7. Provide evidence of faculty engagement in scholarship and service in the table below.**

The chemistry faculty members have always been very engaged in research. In recent years, they have been successful at attracting external funding (Table 14). Their strength is reflected by the number of peer-reviewed publications as well as by their commitment to undergraduate research (Table 15).

**Table 14. Faculty Extramural Research Awards.**

| Fiscal Year | Type of Resource | Approximate Dollar Amount |
|---|---|---|
| **2003** | | |
| **2004** | | |
| **2005** | | |
| **2006** | | |
| **2007** | Senior Research Grant, Indiana Academy of Science, 2007-2008 | $ 3,000 |
| | ACS Division of Organic Chemistry Faculty Travel Award for Faculty at Undergraduate Institutions for travel to the ACS National Meeting in Chicago | $ 600 |
| **2008** | The Dorothy and Moses Passer Education Fund, Division of Chemical Education, American Chemical Society | $ 700 |
| | Sigma Xi Grants-in-Aid of Research (GIAR) program for a student | $ 1,000 |
| | Student travel award from American Chemical Society Women Chemist Committee | $750 |
| **2009** | | |

Since 2003, chemistry faculty members have published 15 journal articles, given 22 conference presentations, and have collaborated with 17 undergraduate students in their research (Table 15). This is a tremendous amount of activity and clearly it indicates the commitment to undergraduate research in chemistry (Table 15). Dr. Kasem, for example, has had 30 undergraduate students participating in his research activities since 1993. He has been consistently funded by the Undergraduate Research Summer Institute (URSI), and has involved his students in publications. His students present their experimental results annually to conferences such as the IU Undergraduate Research Conference, the local ACS conference, and at various national conferences for undergraduate research. Dr. Xie started at IU Kokomo in 2005. She has had 7 students working in her research lab since then, and some of them have received grants to travel to ACS National Conferences to present their research findings. Thus, the chemistry faculty are very active researchers and completely involve undergraduate students in their research activities. Complete lists of publications by chemistry faculty members are included in the curricula vitae of these individuals which appear as Appendix 1 of this report.

**Table 15. Faculty Scholarly Publications and Presentations**.

| Year | Books | Book Chapters | Refereed Journal Articles | Conference Presentations | Number of undergraduate students in research* |
|---|---|---|---|---|---|
| **2003** | | | 2 | | 1 |
| **2004** | | | 1 | | 2 |
| **2005** | | | 1 | | 1 |
| **2006** | | | 1 | 1 | 1 |
| **2007** | | | 3 | 7 | 4 |
| **2008** | | | 2 | 9 | 3 |
| **2009** | | | 2 | 5 | 5 |

* Some students worked for more than one year in a lab. In such case, they are only counted once and their first year of undergraduate research is indicated.

Dr. Kasem was the only active researcher in chemistry on campus until Dr. Xie's arrival in 2005. In brief, Dr. Kasem's research focuses on the synthesis and characterizations of functional nano- and micro-structures with novel electronic and photonic properties. The research activities involve synthesis of inorganic and organic semiconductors and an examination of their surface chemistry and nano- and micro-pattern assemblies. Dr. Kasem uses photo-electrochemical techniques as characterization tools for fundamental heterogeneous charge transfer and photo-physical processes. In particular, he studies the manner in which fundamental physical quanta - electrons, photons, and phonons - are coupled to each other and can be manipulated to for use in technological applications.

Dr. Xie's career at IU Kokomo began in 2005. Her research focuses on the study of the structures of organic solid molecules and how the packing structures affect their properties. The research activity involves the synthesis of a series of small organic acids that are unusual enantiomeric pairs and differ only in the position of their double bond. Dr. Xie uses X-ray diffraction to study their pseudo superimposition in the packing structures. The research activity also involves the design and synthesis of racemic carboxylic acids and their derivatives for a study of the enantiomeric carboxylic acids crystallization pattern and the conglomerate formation for chiral resolution through preferential crystallization.

Chemistry faculty members are very active in a variety of service activities both on campus and off-campus as outlined below. They are completely engaged in their professional societies and are active citizens of the campus. A list of the service work performed by each of the four chemistry faculty is presented in Appendix 2 of this report.

**8. Student Awards and Special Recognition**

- Jason Hull – Outstanding NIMS student, 2009
- Holly Stein received travel support from Center for Research and Creative Activity, IU Kokomo to attend the ACS National Meeting in Salt Lake City in March 2009. $650.
- Holly Stein received a $1000 grant from the Sigma Xi Grants-in-Aid of Research (GIAR) program, which is the maximum that can be offered to students (Grant ID Number: G200803150106). 2008-2009.
- Caryn O'Hearn received the travel award from American Chemical Society Women Chemist Committee (ACS-WCC) to attend the ACS National Meeting in New Orleans in April 2008. $750.
- Holly Stein received travel support from Undergraduate Research Center, IU Kokomo to attend the ACS National Meeting in New Orleans in April 2008. $750.
- Colin Kenny attended the Green Chemistry summer school in Mexico City, Mexico in June 2007, with a scholarship from ACS and NSF to cover all expenses.
- Colin Kenny received travel grant from Office of Vice Chancellor for Academic Affairs, IU Kokomo to support him attending the ACS National Meeting in Chicago in March 2007.

## E. Potential

**1. What is the program's maximum capacity for majors and minors with current resources? What is the maximum for service courses? In the last five years, what steps have been taken to strengthen the program and increase enrollment, and eliminate underused capacity?**

With current resources and course offerings the B.A. in Chemistry degree can handle up to 8-10 chemistry majors graduating each year. This is based on courses having a maximum enrollment of 16-24 students, and takes into account that several upper level courses are currently offered only every other year, with juniors and seniors taking the classes together. In organic chemistry, many students are pre-med biology majors, thus taking seats that could be used for potential chemistry majors (thus limiting the capacity to enroll a greater number of chemistry majors). Another factor to consider is the emphasis on undergraduate research. It is now a hallmark of the School of Arts and Sciences that every graduate will have had some experience in undergraduate research. Since there are only two research-track chemistry faculty, it would be unreasonable to expect that more than 8-10 chemistry majors could be involved in research projects per year. There is also capacity for another 10-12 students to minor in chemistry per year if they follow the right sequence of courses.

**2. Has the program implemented any measures to increase efficiency in the last five years? Describe any reallocations of greater efficiency within the program or department. How might the program improve productivity through consolidation or through internal/external partnerships?**

Perhaps the most important aspect of this self study is the reflection that it engenders. As a result of this study we affirmed several important and very positive things:

- Our tenure-track faculty are very productive as researchers who have engaged and inspired our students to do publishable and reportable research projects;
- Our faculty are heavily engaged in their roles as teachers; teachers not only of information from the various branches of chemistry but, as importantly, teachers of the critical thinking processes that characterize those who are successful in any branch of science and mathematics;

- Our faculty are talented instructors, not only in majors' courses but, in many ways as importantly, in their nonmajors courses, making the relevance of chemistry in our daily lives clear to students in all majors;
- Our faculty are strongly committed to service to the discipline and its professional societies, to the campus, and to the greater community

We also recognize and acknowledge what is, perhaps, our major challenge:

- The number of students opting to major in Chemistry is lower than we would like so we need to create an effective means of attracting entering freshmen into the Chemistry major

As we moved through the self-study we held lengthy discussions about enrollment and retention of majors amongst ourselves, with the NIMS Chair, and with the Interim Dean of Arts and Sciences. We also met with the Chair of the Department of Chemistry and Biochemical Biology/Department of Forensic and Investigative Sciences Program at IUPUI, Dr. Jay Siegel to explore the possibility of a joint effort in forensic sciences. We recognize that, while we've instituted numerous efforts to attract students to campus and to our discipline, we need to do more both to attract students to chemistry at IU Kokomo and to attract IU Kokomo students to chemistry.

One approach we have looked at is to enhance the attractiveness of our degree structure. To this end we have considered several options:

- **Option 1**: Continue to offer a B.A. in Chemistry but with two separate tracks: General Chemistry and Chemical Biology
- **Option 2**: Continue to offer a B.A. in Chemistry but with two separate tracks from which students could choose: General Chemistry and Biochemistry/Molecular Biology
- **Option 3**: Continue to offer a B.A. in Chemistry but with two separate tracks from which students could choose: General Chemistry and Environmental Chemistry
- **Option 4**: Continue to offer a B.A. in Chemistry but with two separate tracks from which students could choose: General Chemistry and Forensic Chemistry
- **Option 5**: Continue to offer the B.A. in Chemistry as it is currently configured
- **Option 6**: Discontinue offering a B.A. in Chemistry and offer a B.S. in Chemistry with General Chemistry and Biological Chemistry tracks

Recognizing that our faculty and our biology degree itself will be undergoing a major shift in emphasis to a molecular approach as we are in the process of hiring two new tenure-track faculty to replace one who resigned and one who will be retiring, coupled with the growth of interest in and importance of biological applications of chemistry, we feel that, in the short term, one way we can attract more students would be to offer Option 1. Students selecting the general chemistry track would be well prepared for graduate studies and/or for laboratory work, likely of an inorganic, organic, or analytical nature; students selecting the chemical biology track would be well prepared for graduate studies and/or work in a pharmaceutical or biochemical setting. For students aspiring to medical school or to an M.D./Ph.D. program, careful selection of electives

will allow all prerequisite requirements to be met. A sample curriculum for the chemical biology track is shown in Table 16. Because of the heavy science course load in the chemical biology option we anticipate that, down the road, we will make a strong case for Option 6, a B.S. in Chemistry degree. However, because of the extensive time required for new degree approval, we think it will be more expedient for us to continue offering a B.A. in Chemistry degree until we can realistically assess the success of adding the chemical biology track.

Realistically however, we know that simply adding a chemical biology track to our chemistry degree program alone will not solve our low enrollment problem. What will be of even greater importance is our ability to market our degree in the high schools. We simply must find effective ways of convincing students of the value and importance of their pursuing degrees in math or science, and hopefully, in chemistry. Further, we must effectively help talented high school students to better understand the necessity of a strong academic performance and the value of their majoring in science (hopefully, in chemistry) in college. Many students find the transition between high school and college much more challenging than they anticipated as they move from a system that often rewards effort to one that values results. Learning to 'own and understand' material requires different study skills than these students developed when their primary focus was on memorization. We intend to explore ways of better utilizing the members of our NIMS Advisory Board to help confirm and elaborate on this paradigm shift, possibly soliciting their participation in video that we could take into the high school chemistry classes to help us tell our story.

**Table 16. Tentative Sample Curriculum for the Chemical Biology Track.**

| Title | Course # | Credits |
|---|---|---|
| Elementary Chemistry I | CHEM-C 105 | 3 |
| Elementary Chemistry I Lab | CHEM-C 125 | 2 |
| Elementary Chemistry II | CHEM-C 106 | 3 |
| Elementary Chemistry II Lab | CHEM-C 126 | 2 |
| Introduction to Biology | BIOL-L 105 | 5 |
| Molecular Biology or Principles of Genetics | BIOL-L 211<br>or BIOL-L 364 | 3 |
| Cell Physiology | BIOL-L 367 | 3 |
| Microbiology (lecture and lab) | MICR-M 310/315 | 2 |
| Analytical Chemistry | CHEM-C 310 | 3 |
| Analytical Chemistry Lab | CHEM-C 311 | 2 |
| Organic Chemistry I | CHEM-C 341 | 3 |
| Organic Chemistry Lab I | CHEM-C 343 | 2 |
| Organic Chemistry II | CHEM-C 342 | 3 |
| Organic Chemistry Lab II | CHEM-C 344 | 2 |
| Physical Chemistry I | CHEM-C 361 | 3 |
| Biological Chemistry | CHEM-C 483 | 3 |
| General Physics I | PHYS-P 201 | 5 |
| General Physics II | PHYS-P 202 | 5 |
| Biological Chemistry Elective* | various | 3 |
| Calculus I | MATH-M 215 | 5 |
| Statistics | MATH-K 310 | 3 |
| Independent Research | CHEM-C 409 or BIOL-L 490 | 3 |
| Capstone Course in Biological Chemistry | NEW | 3 |

* Electives: Bioinformatics, Inorganic Chemistry, Green Chemistry and Sustainability Sciences, Organic Spectroscopy

## F. Additional Information

**Provide information about any special considerations that contribute to the program's importance to the campus or that affect the program that has not been covered above.**

Over the course of several years, we have transitioned to the use of laboratory manuals written by our chemistry laboratory supervisor and printed in-house instead of lab manuals purchased from major publishers. In all of the freshman laboratory classes except for CHEM-C 125 we now use our own lab manuals (the C125 manual is in transition: roughly half of the experiments are purchased and the others are our own.) There are several obvious benefits to this transition. The main one is the financial advantage for our students: the cost of our lab manuals to the students is approximately 25% of the cost of a standard lab manual. In addition, these manuals are written explicitly for our use: they include safety information and directions that are specific to our laboratory situation, equipment and setup. In addition we can easily modify our experiments as necessary to reflect changes in course content. Further, we can rewrite or modify any material that is not clear to students for inclusion in the next printing. While some of the exercises are standard freshman laboratory experiments, some are not. For example, the CHEM-C 120 and CHEM-C 125 students determine the Caloric content of a food item using a Parr Bomb Calorimeter, and estimate the protein content of foods using a Kjeldahl apparatus. The apparatus for each experiment was purchased with an NSF ILI grant in 1996 (Indiana University Strategic Directions Initiative grant (SDC Proposal #1996-186), "*Making Interesting, Real-Life Connections for Non-Majors Studying the World of Chemistry*" $8,876). Because this equipment is not generally available for freshman chemistry students, lab manuals do not include experiments that incorporate its use. As another example, the CHEM-C 122 lab manual includes a qualitative analysis experiment that has been adapted for non-majors with no background in IR or NMR spectroscopy and incorporates the use of the qualitative analysis software package that we use in the more advanced classes.

Owing to the size of our chemistry faculty (four full-time faculty: one professor, one assistant professor, one chemistry laboratory supervisor, and one senior lecturer) and the number of service courses we provide for non-major students completing their general education courses, for students in the nursing program, and for students completing the prerequisites for transfer into our own Radiography and Medical Imaging programs as well as into the various allied health programs requiring chemistry courses (dental hygiene, cytotechnology, clinical laboratory science, nuclear medicine, and others), our faculty have complex teaching loads. A brief description of the nonmajor courses we teach and the frequency with which we offer those courses appears in Table 17. Data describing the enrollment in these courses appears in Table 18.

**Table 17. Nonmajor Service Courses Taught by Chemistry Faculty**

| Course | Description | Mode of Teaching | Frequency |
|---|---|---|---|
| **CHEM-C 100 The World of Chemistry (3 cr)** | Taught on rotating basis by all three faculty members; no prerequisites; frequently use the ACS text *Chemistry in Context*; designed to help students recognize the role chemistry plays in their lives, to develop their quantitative and critical thinking skills, and to be wiser consumers, voters, and citizens of the planet | Lecture format in traditional 16-week semester and condensed 8-week summer session; hybrid (half online) 8-week ACCEL format | Fall, Spring, and Summer I |
| **CHEM-C 120 Chemistry Laboratory (2 cr)** | Taught by Sara Deyo; experiments specifically designed to correlate with the subject matter presented in C100 as presented in *Chemistry in Context*. | Traditional 16-week and condensed 8-week formats; | Fall, Spring, and Summer I |
| **CHEM-C 101 Elementary Chemistry I (3 cr)** | One semester general chemistry course taught on rotating basis by two faculty members. | Lecture format in traditional 16-week semester | Fall and Spring |
| **CHEM-C 121 Elementary Chemistry Laboratory I (2 cr)** | Laboratory experiments designed to illustrate concepts addressed in C101; taught by Sara Deyo | Traditional 16-week format | Fall and Spring |
| **CHEM-C 102 Elementary Chemistry II (3 cr)** | One semester organic-biochemistry course most recently taught on rotating basis by two faculty members; C101 is prerequisite but some students have taken the course without the prerequisite | Lecture format in traditional 16-week semester | Spring |
| **CHEM-C 122 Elementary Chemistry Laboratory II (2 cr)** | Laboratory experiments designed to illustrate the concepts addressed in C102; taught by Sara Deyo | Traditional 16-week format | Spring |
| **CHEM-C 390 Environmental Science (Special Topics) (3 cr)** | Variable title nonmajors course with no prerequisites; recent emphasis on the fundamental chemistry of water; its importance to life on the planet, and global water issues; taught by one faculty member | Hybrid (half online) 8-week ACCEL format | Spring |

**Table 18. Enrollment in Non-Major Service Courses (course credit hours are in brackets).**

| | C100 | C120 | C101 | C121 | C102 | C122 | C390 | Total |
|---|---|---|---|---|---|---|---|---|
| **Fall 2003** | 43 (129) | 14 (42) | 31 (92) | 27 (54) | | | | **115 (317)** |
| **Spring 2004** | 56 (168) | 12 (24) | | | 5 (15) | 4 (12) | 21 (63) | **98 (282)** |
| **Fall 2004** | 49 (147) | 17 (34) | 57 (171) | 46 (138) | | | | **169 (490)** |
| **Spring 2005** | 52 (156) | 5 (10) | 30 (90) | 23 (69) | 8 (16) | 5 (10) | | **123 (351)** |
| **Summer 2005** | 25 (75) | 17 (54) | | | | | | **52 (109)** |
| **Fall 2005** | 58 (174) | 16 (32) | 43 (129) | 32 (64) | | | | **149 (399)** |
| **Spring 2006** | 65 (195) | 16 (32) | 32 (160) | 27 (54) | 6 (18) | 5 (10) | 11 (33) | **162 (502)** |
| **Summer 2006** | 24 (72) | 16 (32) | | | | | | **40 (104)** |
| **Fall 2006** | 37 (111) | 8 (16) | 34 (102) | 25 (50) | | | | **104 (279)** |
| **Spring 2007** | 42 (126) | 25 (50) | 23 (69) | 16 (32) | 3 (9) | 2 (4) | | **111 (290)** |
| **Fall 2007** | 23 (69) | 16 (32) | 42 (210) | 35 (70) | | | | **116 (312)** |
| **Spring 2008** | 39 (117) | 16 (32) | 25 (75) | 22 (44) | 4 (12) | 4 (8) | 24 (72) | **134 (360)** |
| **Summer 2008** | 30 (90) | 11 (22) | | | | | | **41 (112)** |
| **Fall 2008** | 30 (90) | 17 (34) | 35 (105) | 31 (93) | | | 30 (90) | **113 (322)** |
| **Spring 2009** | 35 (105) | 17 (34) | 35 (105) | 25 (75) | 7 (21) | 6 (12) | 60 (180) | **185 (532)** |
| **Fall 2009** | 55 (165) | 16 (32) | 52 (156) | 19 (57) | | | | **142 (410)** |

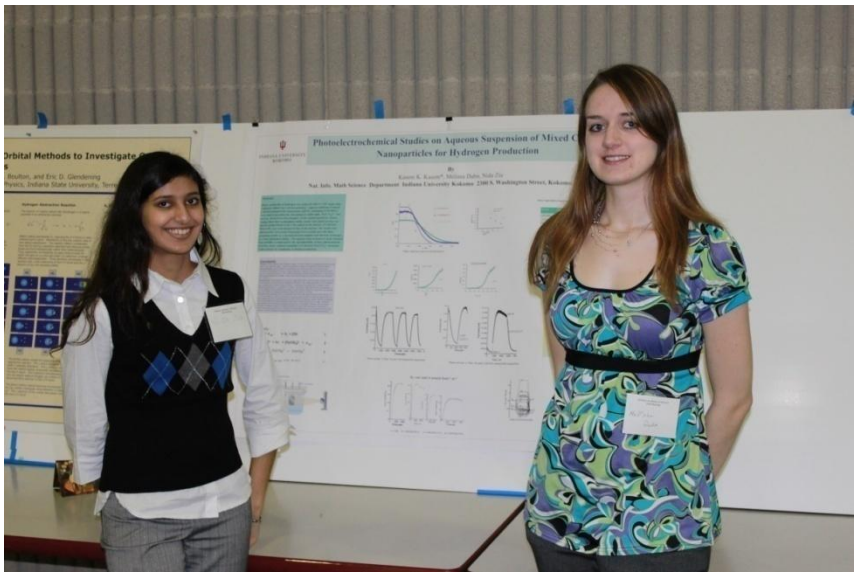
As is evident from the data in Table 18, enrollment in our service courses is high and has been growing since 2003, peaking at 532 credit hours in Spring 2009. These are important courses from the perspective that one of the important roles of chemistry faculty is to prepare students for admission into allied health areas, many of which require chemistry course(s) and their associated laboratory class(es). In addition, these courses are an important aspect of the general education requirements. These courses are difficult to teach, primarily because of the responsibility of faculty to change the negative perceptions many non-majors have of the subject. In many respects, teaching these courses represents a greater challenge for the chemistry faculty than are represented when they teach receptive students majoring in chemistry, biology, and/or other scientific disciplines.

## In Summary

In 1851 Justice von Liebig wrote in *Familiar Letters on Chemistry*,

> "Only about seventy years ago was chemistry, like a grain of seed from a ripe fruit, separated from the other physical sciences. With Black, Cavendish, and Priestley, its new era began. Medicine, pharmacy, and the useful arts, had prepared the soil upon which this seed was to germinate and flourish,"

The B.A. in Chemistry is strong and continues to flourish at Indiana University Kokomo. As faculty we know that the B.A. in Chemistry major, still in its relative infancy, requires fertilizer and sunlight, and we are prepared to provide the nourishment it needs to increase its visibility and to make it a desired choice for more of our students.



## Appendix 1: Abbreviated Curricula vita of Chemistry Faculty

**I. Faculty Member: KASEM K. KASEM,** Professor of Chemistry and Member of the Graduate Faculty

**Education:**

B.Sc. Chemistry, School of Science, Assiut University, Assiut, Egypt 1971
M.Sc. Electrochemistry, School of Science, Assiut University, Assiut, Egypt 1975
Ph.D. Electrochemistry, School of Science, Assiut University, Assiut, Egypt 1978
Post-Doctoral Fellow, Cornell University, Ithaca, NY 1986-88
Post-Doctoral Fellow, Purdue University, West Lafayette, IN 1988-89

**Professional Experience**

**Indiana University Kokomo**

Professor of Chemistry - 2003-present
Associate Professor of Chemistry - 1997- 2003
Assistant Professor of Chemistry - 1991-1997

**Indiana State University, Terre Haute, IN**

Assistant Professor of Chemistry (Sabbatical Replacement) - 1989-1990

**IUPUI, Indianapolis, and West Lafayette, IN**

Postdoctoral Research Associate - 1988-1989.

**Cornell University, Ithaca, NY**

Postdoctoral Visiting Scientist - 1986-1988.

**Al Fateh University, Tripoli , Libya**

Assistant professor of Chemistry - 1981-1986

**Assiut University, Assiut, Egypt**

Lecturer of Chemistry - 1978-1981

**Research Activities and Interests**:

**2000-Present** Studies on photo-induced heterogeneous charge transfer process in aqueous colloidal solutions; Some organic semiconductors will be used to modify the surfaces of the prepared colloidal particles The purpose of this study is to create new inexpensive Inorganic/organic interface (IOI) semiconductor assemblies that can be used for photo conversion of solar radiations within λ range between 450 -800 nm for possible applications in Hydrogen production.

**1991-2000** Research projects on the electrochemical behavior of free and immobilized polyoxo-metalates in aqueous and mixed solvent electrolytes. Photoelectrochemistry of inorganic and organic semiconductors. Electrocatalytic activities of these polyoxometalates are also under investigation. URSI projects on electro- chemical application of chemically modified electrodes as biosensor enzyme electrodes). Characterization of surface modified electrodes with doped diamond.

**1989-1990** Electrochemical studies (Purdue University, West Lafayette) on the lipophile exchange membranes as electro-active assemblies on the electrode surface.

**1988-1989** NSF research project (West Lafayette/ Indianapolis), in characterization of electro-chemical behavior of transition metal complexes Dynamic voltammetric techniques, and chemically modified electrodes are being used to characterize rates and mechanisms of electrode reactions.

**1986-1988** Research project at Cornell University (Ithaca, NY) on application of modified electrodes in trace analysis; coordination trends, the selectivity and sensitivity of such electrodes were also studied. Photoelectrochemical studied of native semiconductor electrodes for solar energy conversion the quantum conversion efficiencies of photoelectrochemical cells were also characterized.

**1983-1986** Collaborative research work with the Ministry of Industry and Al-Fateh University (Tripoli, Libya) in the electrical properties of inorganic phososphates and their polymers. Polymers of either Ti or Zr phosphate or mixed metal phosphates were prepared and investigated with respect to their electrical conductivity.

**1978-1983** Collaborative research work at Assiut university in electro-organic synthesis of some organic acids and esters and electro-reduction of ketones using surface derivatized electrodes. Designed electrodes for biological systems. Studied non-toxic baths for electrodeposition of some transition metals. Co-operative research project with Industrial & Financial Co. (Quna, Egypt) in the corrosion studies of some of their products (metals and alloys). Co-supervised two M.Sc theses.

**1975-1978** Anodic preparation of bulk and surface attached films of oxides on Al and Al-Mn alloys in organic and inorganic acid baths. These systems were characterized by X-ray diffraction and by electrochemical instrumentation. Thermodynamic functions were calculated from the data analysis of temperature variations in these systems. Possible

applications for preparation of porous and microelectrodes, as well as ceramics were also investigated.

**1972-1975** Electrodeposition of some binary alloys of Cd-Ni. The study, which was a part of my M. Sc. Degree, covered the analytical and physical aspects of the electroplating process. Anti-corrosion properties of these alloys under marine environments were also investigated.

**Courses Taught**

Graduate Research in Chemistry, Undergraduate Research in Chemistry
Physical Chemistry (200 & 300 level)/Lab. Inorganic Chemistry
Analytical Chemistry (300/400 level)/Lab.
General Chemistry. Introductory Chemistry for non-chemistry majors.

**Teaching Honors:**

**2000:** Claude Rich Excellence in Teaching Award.
**1999:** Indiana University Teaching Excellence Award
**1997:** Indiana University Teaching Excellence Award

**Publications:**

"Photodissociation of Aqueous Colloidal Nano-particles of Doped Titanium (IV) Oxides Semiconductors For hydrogen Production" Submitted to Current Science

"Hydrogen Production by Selective Photo-dissociation of Water in Aqueous Colloidal Nano-particles of Doped Iron (III) Oxides Semiconductors" . J. Mat. Sci. & Techno., 2010, In press.

"Electrochemical Studies on Metal-Hexacyanocobaltate (III) Thin Solid Films in Aqueous Electrolytes" J. Mat. Sci. Poland , 2010, In press

"Photoelectrochemical Studies on Poly 1-( 2-Aminophenyl)Pyrrole: Creation of a Photoactive Inorganic /Organic Semiconductor Interface (IOI) ". Canadian J. of chem.**, 2009, 87, 1109-1116.**

"Selective Photolysis of aqueous colloidal nano-particles of some metal oxide semiconductors for hydrogen production". Oriental journal of Chemistry, **2009**, 25, 1-6

"Photo-generation of Hydrogen from Aqueous Colloidal Nano-particles of Some Metal Oxides Semiconductors" Proceeding of Cairo 11$^{th}$ International Conference, and 8$^{th}$ World Solar Electricity Conference, **2009.**

Photo-electrochemical Studies on Poly 1-( 2-Aminophenyl Pyrrole): Creation of Photoactive Inorganic /Organic Semiconductor Interface (IOI)" Material science An Indiana journal In press.**2009**

"Photo-Electrochemical Studies on Colloidal Copper (I) Oxide/Modified with Some Organic Semiconductors; Incentive for the Use of Nano-Particle Systems," Bulletin of Material Sciences, **2008, 31(7) 1-5**

"Platinum as Reference Electrode in electrochemical measurements" Published in Platinum Metals review, **2008,** 52 (2) 100-106.

"Photo-electrochemical Studies on copper Oxides/Chalcogenides Semiconductors" 10$^{th}$. International Conference on Energy and Environment, **2007**

"Electrochemical Behavior of Hexacyano Iron (III) In Frozen Aqueous Electrolytes" American Journal of Undergraduate Research. **2006**, 5(4) 25.

"Electrochemical Behavior Of Some Redox Systems Pendant in Agar Gel". *J. of New materials for Electrochemical Systems,* **2005**, 8(3), 189-195.

"Electrochemical, Catalytic Behavior of Iridium Hexacyanometalate Thin Films in Aqueous Electrolytes. *Platinum Metals Review, **2004**, (48)4, 159-167.*

Electrochemical Synthesis of Zeollite-like Ruthenium Based Hexacyanometalates Multi-film Assemblies. J. Microporous and Mesoporous Materials, 66, **2003**,133-141.

Electrochemistry in Thin Solid Films of Prussian Blue; A Model Demonstration of Reversible Behavior. Kasem K.. Kasem Et al, ***American Journal of undergraduate Research*** , 2(1), **2003**, 27-36.

Electrochemical Studies on Substituted Iron-Hexacyano iron (III)Bi-Layered Thin Films at Glassy Carbon Electrode/Electrolyte Interface. ***J. Interface Science***, 10, **2002**.261-269

Electrodeposition of Catalytically Active Mixed Solid Films of Hexacyanoferrates and Decavanadates". K. Kasem, *J. Applied Electrochemistry , 31, **2001**,1125-1129.*

Electrochemical Behavior of Iron-Hexacynoruthenate(II) Thin Films in aqueous electrolytes: potential analytical and catalytic applications. K. Kasem, *Material Science & Engineering B,83, **2001**, 97-105*

Electrochemical and Adsorption Studies on the Formation of Poly 8-Hydroxyquinaldine Thin Films at Glassy Carbon /Electrolyte Interface. K. Kasem, *J. Interface Sciences, 8, **2000**, 111-121.*

Photoelectrochemical Studies on Stationary surface Modified CdSe electrodes. *J. Mat. Sci. &Eng. B65. **1999,** 127-134.*

Electrodeposition of Doped Solid Film of Phosphomolybdates. K. Kasem, *J Applied Electrochemistry,29, **1999,** 1471-1473*

Photo-electrochemistry at Polymer/Semiconductor Interface. Characterization of Surface Modified CdS Based Photovoltaic Cells. K. Kasem, *J. Material Science, 34,**1999,**5273-5242.*

Modified electrodes with synthetic bio-catalytic membrane. Kasem Kasem, Josie Sheets, and Natalie Koon. *Biotechnol. Progress, 14, **1998**, 791-796.*

Electrochemical behavior of Sodium 12-Tungstodicobaltoate in aqueous and mixed solvent electrolytes. K. Kasem, *J. of Electrochimica Acta, 41(2), **1996**, 205-211*

Effect of both electrode material and polymer configuration on the performance of the electrochemical sensor based immobilized enzyme electrode. Kasem K. Kasem, Josie Sheets and Natalie Koon, *Annali di Chimica, 86, **1996**, 449-461.*

Electrochemistry of Polyoxometalates Immobilized in Ion Exchange Polymers Films. K. Kasem and F.A Schultz, *Canadian Journal Of Chemistry, 73, **1995,** 858-864.*

Modified electrodes for electrocatalysis. Kasem K. Kasem and F.A. Schultz. Proceedings of the *Indiana Academy of Science, 104(3-4), **1995,** 185-192.*

Ion Exchange and Charge transport Properties of Polymeric Tris(4-vinyl-4'-methyl-2,2'-bipyridine) ruthenium(II) Films. Kasem K. Kasem and F.A Schultz, *J. of Inorganic and Organometallic polymers , 4(4) **1994,** 377-390.*

Solvent Effects on the Redox Behavior of Silicotungstates in Mixtures of Some Oxoanions and Their Potential Analytical Applications. Kasem K. Kasem, *Annali Di Chimica, 84, **1994**, 365-377..*

Effect of the anodization current density and time on the corrosion of Al-Mn alloy. Abou-El-Wafa, Moustafa H.M.; El-Cheikh, Hesham Mansour, F.M.; Kasem, K.K.. *Commun. Fac.Sci. Univ. Ankara, Ser. B: Chem. Chem. Eng. **(1994)**, 36(1-2), 27-35.*

Effect of Competitive Binding on the Amperometric Determination of Copper with Electrodes Modified with Chromotrope 2B. K.K. Kasem and H.D. Abruna. *Talanta 38(1) **1991**, P. 89-93 .*

Lipophile Exchange Membranes as Electroactive Assemblies on Electrode Surface. K.K. Kasem, M. Zelden, W. Fife, and Charlis R. Leinder. *J. of Electroanalytical Chemistry. 296,* ***1990****, P221-231.*

Effect of some trimethine merocyanine dyes on the corrosion of aluminum and aluminum manganese.Abou-El-Wafa, Moustafa H. M.; Mansour, Hesham; El-Cheikh, F. M.; Kasem, K. K.. *Pak. J. Sci. Ind. Res.* ***(1990)****, 33(5-6), 208-12.*

Anodization of aluminum and some of its alloys in organic and inorganic acids Mansour, Hesham; Abou-El-Wafa, Moustafa H. M.; El-Cheikh, F. M.; Kasem, K. K. *J. Indian Chem. Soc.****(1989)****, 66(12), 908-10.*

Role of acid concentration on the anodic film properties of aluminum and aluminum-manganese alloy. Abou-El-Wafa, Moustafa H. M.; Mansour, Hesham; El-Cheikh, F. M.; Kasem, K. K.. *J. Indian Chem. Soc.* ***(1989)****, 66(12), 858-61.*

Effect of the anodization current density and time on the corrosion of aluminum and aluminum-manganese alloy. Abou-El-Wafa, Moustafa H. M.; Mansour, Hesham; El-Cheikh, F.M.; Kasem, K. K. *Pak. J. Sci. Ind. Res.* ***(1989),*** *32(6), 366-9.*

Electroanalysis with Modified Carbon Paste Electrodes; Coordination Trends, Selectivity and Sensitivity. K.K. Kasem, Hector D. Abruna. *J. of Electroanalytical Chemistry. 242,* ***1988,*** *87,*

Efficiency of alkylamines in retarding the dissolution of electrolytic cadmium. Noubi, G. A.; Gahli, H.; Kasem, K.; Mansour, H. *J. Electrochem. Soc. India* ***(1982),*** *31(4), 182-7.*

Effect of Aliphatic Acid Anions on the Standard Potentials of Calomel Like Electrodes. K.K. Kasem, *Annali di chimica, 72,* ***1982,*** *503-9.*

Additional Physical Properties of Butyrate and Iso-Butyrate Anions. K.K. Kasem and M.T. Esmaeil, *Revue Roumaine de Chimie, 27,* ***1982****, 479.*

Electrosynthesis of Organic Compounds I-Synthesis Succinic, Adipic, and Suberic Acids, and their Methyl Esters. Ismail, M.T., K.K. Kasem, and Abdel-Wahab. A.A. *Bull. Sci. Assiut University, 11(1),* ***1982,*** *121-6.*

The Electrodeposition of Zn and Ni in the Presence of Acetylacetone; the Behavior of Ligand as Both an inhibitor and Depolarizer. M.M. Aly, f.M. El-chiek, K.K. Kasem, and H.M. Kilia. *J. of the Indian Chemical Society, 57(12),* ***1980,*** *1223-5.*

Electrodeposition of Cd-Ni Alloys from Solutions Containing Organic Anions. M.M. Aly, F.M. El-Chiek, and K.K. Kasem. *Revue Roumaine de Chimie. Vol. 24,* ***1979,*** *506.*

The Effect of Halides on the Corrosion of Zinc in Acidic Medium. F. El-Chiek, G. Nobi, and K. Kasem. *Bull. of Sci. Assiut University. 7(1).* ***1978****, 1*

A Study on the Effect of Amino Acids on Al-Mn Alloy Corrosion in HCl Solution. F. El-Chiek, G. Nobi, and K. Kasem, *Bull. of Faculty of Sci. Assiut University. 7(1).* ***1978****.*

A Glycinate Bath for Cd-Ni Alloys. F. El-Chiek, I.M. Issa, and K. Kasem. *Annali di Chimica. Vol. 67.* ***1977.***

**Papers presented at National and International Meetings**

**2009:** Cairo 11th international conference, and 8th world solar electricity, **2009.**

**2007:** ***Tenth international conference on Energy and environment, Luxur, Egypt March 2007.***

**2001: 28th Annual Conference of FACSS** (Ferd. Of Analyt. Chem. & Spect. Soc.), **Detroit, Michigan**
Electrochemical Charge Exchange.

**1993: International Electroanalytical Symposium**, **Indianapolis, IN**

Electroanalytical determination of silicotungstates in a mixture of some oxoanions; Solvent effect criteria.

Electrochemical behavior of Sodium 12- Tungestodicobaltoate in aqueous and mixed solvent electrolytes.

**1989: American Chemical Society (197th) Dallas, TX**

Ion exchange and charge transport properties of polymeric $Ru(vppy)_3$ films.

Incorporation and electrocatalytic properties of polyoxometalates in ion exchange polymer films.

**Undergraduate Research Conferences:**

**2007: 8th Annual ACS Indiana Section Eli Lilly and Company, Indianapolis, IN.**

" Photoelectrochemical Studies on Metal Oxides Semiconductors Assemblies"

**2006: 7th Annual Indiana local section of American chemical Society. Earlham College, Richmond, IN.**

"Photo-Electrochemical Studies on Copper Oxide/Chalcogenide Semiconductors"

**2005: 6th Annual ACS Indiana section held at AgroScience in Indianapolis ,**

**"**Electrochemical Syntheses of Some Aniline Derivatives Co-polymers in Mixed solvent Electrolytes"

**2005: IUURC November 7,2005 at IUPUI (Indianapolis).**

**"**Electrochemical Syntheses of Some Aniline Derivatives Co-polymers in Mixed solvent Electrolytes"

**2003: IUURC November 7,2003 at UIPUI (Indianapolis).**

**"**Electrochemical Syntheses of Some Aniline Derivatives Co-polymers in Mixed solvent Electrolytes"

**2002: 3rd Annual Indiana Local Section of ACS at Butler University in Indianapolis**

**2002: IUURC November 8, at UIPUI (Indianapolis)..**

**2001: 2nd ACS regional meeting, Dow AgroSciences, Indianapolis, IN.**

**"**Electrochemical synthesis of ruthenium based hexacyanometalates bilayered thin films". (Students: Trent Miller, and Angela Zimmerman, Ryanne Hazen, Margaret Rosanne Spaulding)

**2000: National Conference on Undergraduate Research**, **University of Montana.MT.**

"Electrochemical behavior of some immobilized hexacyanometalates" (Students, A Croxford, D. Henninger, and F. Phetteplace)

**1999: National Conference on Undergraduate Research**, **Rochester, New York.**

"Electrochemical studies on Poly 2-Aminophenyl Pyrrole in aqueous electrolytes" (Student: Sarah Menages) spelling?

**1998: National Conference on Undergraduate Research**, **Baltimore, MD**

"Electrochemical behavior of free and immobilized 9-Tungesto 3- Vanado- Phosphate in aqueous and mixed solvent electrolytes" (Student: Laura Canon)

**1997: National Conference on Undergraduate Research**, **Austin , TX**.

"Electrochemical behavior of some mixed addendia" (Students: Becky Boardman, Robin Carter)

**1996: National Conference on Undergraduate Research**, **Asheville, NC**.

"Surface modification of glassy carbon electrodes: Polyoxometalate-based polymer films as modifier for electrode surfaces. (Students: Jo Russeau, Gena Morandi)

**1995: National Conference on Undergraduate Research**, **Schenectady, NY**.

"Modified Glassy carbon electrodes' surfaces as electrochemical sensor for enzyme- substrate interaction." (Students: Natalie Koon, and Josie Sheets)

**1994: National Conference on Undergraduate Research**, **Kalamazoo, MI**.

"Enzyme electrode based immobilized glucose oxidase in polymer films." (Student: Josie Sheets)

**Invited Seminars and Presentations**

**1-** T.J Research Center, IBM, NY

" Ion exchange and charge transport at chemically modified electrode, Possible application in direct on-line monitoring of ion concentration"

**2-** University of Toledo, Department of Chemistry

"Analytical application of chemically modified electrodes"

**3-** Indiana University Northwest, Department of Bio. & Phys. Sci.

"Charge transfer in polymeric films"

**4-** Eastern Illinois University, Department of Chemistry

Chemically modified electrodes

**Grants Received*:***

**2008** **$4000** Grant in Aid to buy solar simulator. Indiana University Kokomo

**2006** **$12000** Indiana University Intercampus Research Funds (RUGS) for my research project Photo-electrochemical studies on some metal oxides semiconductors

**2006** **$7000** Indiana University Summer faculty fellowship

**2004** **$7000** Indiana University Summer Faculty fellowship

**2002** **$7000** Indiana University Summer faculty Fellowship

**2001** **$6000** Indiana University Summer Faculty Fellowship

**2000** **$17225** Department of the Navy-ASEE.

**1999** **$12,000** Indiana University Intercampus Research Funds (RUGS) for my research project A Characterization of Surface Modified Electrodes@

**1999** **$2500** ELCHEMA A Electrochemical Instrumentation Co. Grant@, Potsdam , NY

**1999** **$6000** Indiana University Summer Faculty fellowship grant

**1996** **$5000** Indiana University Summer Faculty fellowship grant

**1994-2001 $8250** Indiana University Undergraduate Research summer Institute (URSI) $1000 for five consecutive years

II. **Faculty Member: SONGWEN XIE,** Assistant Professor of Chemistry

**I. Education**

**Ph.D.**, Organic Chemistry, Department of Chemistry and Biochemistry, Southern Illinois University at Carbondale (SIUC), 2005
Dissertation title: Synthesis, diastereomer identification and enantiomer resolution of non-steroidal estrogenic carboxylic acids for a structure-physiology correlation study.
Advisor: Prof. Cal Y. Meyers

**B.S.**, Organic Chemistry, College of Chemistry and Molecular Engineering, Peking University (PKU), PR China, 1999
Thesis title: Preparation and Preliminary Application of Polyclonal Antibodies to Lysophosphatidic Acid.
Advisor: Prof. Jiahua Chen

**II. Professional Experience**

**Assistant Professor of Chemistry** (August 2005 – Present)

Department of Natural, Information, and Mathematical Sciences, Indiana University Kokomo

- General research interest:
  - Synthetic organic chemistry
  - Mechanistic study for organic reactions
  - X-ray crystallography of organic molecules
  - Stereochemistry
  - Chemical education
- Synthesis of a series of unusual enantiomeric pairs that differ only in the position of their double bond and a study of their pseudo superimposition in the X-ray structures
- Design and synthesis of racemic carboxylic acids and their derivatives: a study of the enantiomeric carboxylic acids crystallization pattern and the conglomerate formation for chiral resolution through preferential crystallization

**Graduate Research Assistant** (2000–2005)

Meyers Institute for Interdisciplinary Research in Organic and Medicinal Chemistry, Department of Chemistry and Biochemistry, Southern Illinois University Carbondale

Advisor: Professor Cal Y. Meyers

- Synthesis of small estrogenic carboxylic acids, purification and characterization by $^{1}$HNMR, $^{13}$CNMR, IR and X-ray crystal structures.
- Chemical methods to resolve the enantiomers of the carboxylic acids by making diastereomeric ester and amide derivatives, and separate them by column or fractional recrystallization. The (+) and (-) enantiomers have potentially different activities towards the biological tests.
- Chiral HPLC for carboxylic acids enantiomer resolution using different chiral columns.
- Binding affinity of the compounds to ER$\alpha$ and ER$\beta$ by competitive binding against fluorescence labeled estradiol. The results showed that the small carboxylic acids did not bind much to the receptors. MCF-7 cell line for estrogenicity of the compounds showed that they were weak estrogens.
- PC-3 cell line for the *anti*-prostate-cancer activity of the compounds showed that they had the ability to inhibit the proliferation of human prostate cancer cell growth. These compounds are potential drugs for curing prostate cancer. My presentation on this project at 2004 ACS National Meeting in Anaheim raised a lot of interest from major pharmaceutical companies, such as Pfizer, Merck, Roche, and Cortex *etc*.

**Undergraduate Research Assistant** (1998-1999)

Bioorganic Molecular Engineering Lab, College of Chemistry and Molecular Engineering, Peking University, PR China

Advisor: Professor Jiahua Chen

- The preparation of the polyclonal antibodies to a functional phospholipid LPA by using LPA as a haptam, non-covalently absorbed on the surface of gold nanoparticles
- By specific antigen-antibody recognition, the LPA antibodies provide a possible diagnostic methodology for cancers in gynecology at the early stage with significantly high level of LPA. This undergraduate research result was published in *Bioorganic and Medicinal Chemistry Letters* in 2000.
- The production and application of monoclonal antibodies to morphine.

### *III. Teaching Experience*

- **Assistant Professor of Chemistry** (2005-present) Department of Natural, Information, and Mathematical Sciences, Indiana University Kokomo
  C341 Organic Chemistry I (5 semesters)
  C342 Organic Chemistry II (5 semesters)
  C343 Organic Chemistry Lab I (5 semesters)
  C344 Organic Chemistry Lab II (5 semesters)
  C105 General Chemistry I (1 semester)
  C351 Green Chemistry and Sustainability Sciences (2 semesters)
  C400 Chemical Information Sources and Services (2 semesters)
  C318 Spectrochemistry and Separations (1 semester)
  C102 Elementary Chemistry II (3 semesters)
  C100 The World of Chemistry (3 semesters)
  C409 Undergraduate research
- **Graduate Teaching Assistant** (2000-2004) Department of Chemistry and Biochemistry, Southern Illinois University Carbondale
  Chemistry and Society (1 semester)
  General Chemistry Lab I (1 semester)

Organic Chemistry Lab I (5 semesters)
Organic Chemistry Lab II (1 semester)

**Student Research Directed**

- Brian Fowler. 2009-2010. Indiana University Kokomo
- Jason Hull. 2009. Indiana University Kokomo
- Stein, Holly. 2007-2009. *Synthesis of 2,6-dimethyl-4-m-substituted phenyl-3-cyclohexenecarboxylic acid and its derivatives for their characterization by X-ray crystallography.* Indiana University Kokomo
- Ingle, Katie. 2008. *Demethylation on anisole derivatives*. Indiana University Kokomo
- O'Hearn, Caryn. 2007-2008. *Synthesis of 2,6-dimethyl-4-p-substituted phenyl-3-cyclohexenecarboxylic acid and its derivatives for their characterization by X-ray crystallography.* Indiana University Kokomo
- Meelyn Pandit. 2007-2008. He is an 11$^{th}$ grade student from Noblesville High School, IN. His science project: extraction and separation of catechins from green tea for bacteria inhibition.
- Davis, Carmen. 2007. *Synthesis of 3-ethyl-2,6-dimethyl-4-phenyl-3-cyclohexenecarboxylic acid.* Indiana University Kokomo
- Kenny, Colin. 2006-2007. *Synthesis and characterization of 2,6-dimethyl-4-phenyl-3-cyclohexene carboxylic acid and its derivatives, unusual enantiomeric pairs that differ only in the position of their double bond*. Indiana University Kokomo
- Ellers, Virginia. 2004. *Resolution of the enantiomers for the small synthetic estrogenic carboxylic acids*. Summer Undergraduate Research Fellowship, Department of Chemistry and Biochemistry, Southern Illinois University Carbondale
- Houg, Kim. 2002. *Synthesis of small estrogenic carboxylic acids*. Summer Undergraduate Research Fellowship, Department of Chemistry and Biochemistry, Southern Illinois University Carbondale

**IV. Honors**

**Awards**

- American Chemical Society (ACS) Younger Chemist Committee (YCC) Leadership Development Award (as one of the fifteen out of more than seventy applicants) to support the participation in the ACS Leadership Development Workshop in Ft Worth, TX on Jan 23-25, 2009.
- The Distinguished Award for Innovative College Science Teaching, from Hoosier Association of Science Teaching, Inc. (HASTI), 2008. The award was presented at the 2008 HASTI Conference in Indianapolis, IN on Feb 8, 2008.
- ACS Division of Organic Chemistry Faculty Travel Award for Faculty at Undergraduate Institutions for travel to the ACS National Meeting in Chicago, as one of the ten faculty members in the US, 2007 ($600)
- Runner-up of the annual Richard and Donna Falvo Outstanding Dissertation Award for 2005, Southern Illinois University, April 2006
- ACS Division of Organic Chemistry Graduate Travel Award, to attend the San Diego ACS national meeting, as one of the five graduate students in the US, 2005 ($600)
- C. David Schmulbach Career Award for Graduate Student Teaching Excellence, Department of Chemistry and Biochemistry at SIUC, 2003 ($300)
- Certificate in Honor and Recognition for Dedication and Esteemed Service to CSSA, from SIUC Chinese Student and Scholar Association (CSSA), 2003
- Certificate in Recognition of Public Service, from SIUC Chinese Student and Scholar Association (CSSA), 2002

**Grants received**

**External**

- Senior Research Grant, Indiana Academy of Science, 2007-2008 ($3000)
- The Dorothy and Moses Passer Education Fund, Division of Chemical Education, American Chemical Society, 2008 ($700)

**Internal**

- Grants-in-aid of Faculty Research, Indiana University Kokomo, 2009-2010 ($4,000)
- Summer Faculty Fellowship, Indiana University Kokomo, Summer 2008 ($6000)
- Grants-in-aid of Faculty Research, Indiana University Kokomo, 2007-2009 ($4,000)
- Grants-in-aid of Faculty Research, Indiana University Kokomo, 2006-2008 ($4,000)
- Fund from Undergraduate Research Summer Institute (URSI), Indiana University Kokomo, 2008 ($1000)
- Fund from Undergraduate Research Summer Institute (URSI), Indiana University Kokomo, 2007 ($1000)
- Oversea Conference Fund, Office of International Programs, Indiana University Bloomington, 2007 ($700)

**Grants rejected**

- American Chemical Society – Petroleum Research Fund (ACS-PRF), Type GB, $50,000 for 2008-2010 (Submitted on November 30, 2007)
- American Chemical Society – Petroleum Research Fund (ACS-PRF), Type GB, $40,000 for 2007-2009 (Submitted on November 30, 2006)

**Student Achievements**

- Holly Stein received travel support from Center for Research and Creative Activity, IU Kokomo to attend the ACS National Meeting in Salt Lake City in March 2009. $650.
- Holly Stein received a $1000 grant from the Sigma Xi Grants-in-Aid of Research (GIAR) program, which is the maximum that can be offered to students (Grant ID Number: G200803150106). 2008-2009.
- Caryn O'Hearn received the travel award from American Chemical Society Women Chemist Committee (ACS-WCC) to attend the ACS National Meeting in New Orleans in April 2008. $750.
- Holly Stein received travel support from Undergraduate Research Center, IU Kokomo to attend the ACS National Meeting in New Orleans in April 2008. $750.
- Colin Kenny attended the Green Chemistry summer school in Mexico City, Mexico in June 2007, with a scholarship from ACS and NSF to cover all expenses.
- Colin Kenny received travel grant from Office of Vice Chancellor for Academic Affaires, IU Kokomo to support him attending the ACS National Meeting in Chicago in March 2007.

**Professional Development**

- Attendance to the 2009 ACS career consultant training (Austin, Texas, Jan 30-Feb 1, 2009)
- Attendance to the 2009 ACS Leadership Institute (Ft Worth, Texas, Jan 23-25, 2009)
- Attendance to the NSF-Sponsored CWCS Workshop on Research-based Lab Curriculum: The Center for Authentic Science Practice in Education Model of Research (University of Illinois at Chicago, IL, June 22-27, 2008)

- Attendance to National Science Foundation Day sponsored by Butler University and the Indiana Economic Development Corporation (Butler University, Indianapolis, IN, October 5, 2007)
- Attendance with scholarship (1200 Euro) to the 39th Course – Engineering of Crystalline Materials Properties: State-of-the-art in Modeling, Design, and Applications (International School of Crystallography, Erice, Sicily, Italy, June 7 – 17, 2007)
- Attendance to the NSF-Sponsored CWCS Workshop on Basic NMR: Fundamentals and Applications (Washington State University, Pullman, WA, May 20-25, 2007)
- Attendance with scholarship ($300) to Green Chemistry "Train-the-Trainers" Workshop (American Chemical Society, Washington DC, June 30, 2006)
- Attendance with scholarship to the ACS-PRF Summer School on Sustainability Science and Technology, as one of the only 16 professionals from around the world (Massachusetts Institute of Technology, Cambridge, MA, August 7 – 13, 2005)
- Attendance with scholarship to the ACS-PRF Summer School on Computation, Simulation, and Theory in Chemistry, Chemical Biology, and Materials Chemistry, as one out of 36 professionals from around the world (University of Utah, Park City, UT, June 11 – 18, 2005)
- Attendance with scholarship to the ACS-PRF Summer School on Green Chemistry, as one of 65 graduate students from around the world (Carnegie Mellon University, Pittsburgh, PA, July 31 – August 7, 2004)

**Professional Meetings Attended**

- The 238th ACS National Meeting, Washington, DC, August 16-20, 2009, gave an oral presentation
- The 14th Indiana University Undergraduate Research Conference, Indiana University Kokomo, Kokomo, IN, United States, November 21, 2008, student gave a poster presentation
- The 56th ASMS (American Society for Mass Spectrometry) Conference on Mass Spectrometry and Allied Topics, Denver, CO, June 1-5, 2008
- The 2nd IU Kokomo Faculty Conference, May 30, 2008, gave an oral presentation and a poster presentation
- The 235th ACS National Meeting, New Orleans, LA, April 6-10, 2008, gave an oral presentation and three poster presentations
- The 2008 Hoosier Association of Science Teaching, Inc. (HSATI) Conference, Indianapolis, IN, Feb 7-9, 2008
- The 13th Indiana University Undergraduate Research Conference, Indiana University Southeast, New Albany, IN, United States, November 30, 2007, students gave two poster presentations
- The 8th Annual Indiana Local Section American Chemical Society Poster Session, at the Lilly Corporate Center, Indianapolis, IN, October 11, 2007, gave a poster presentation
- The 233rd ACS National Meeting, Chicago, IL, March 25-29, 2007, gave an oral presentation and a poster presentation
- The 12th Indiana University Undergraduate Research Conference, IUPUI, Indianapolis, IN, November 17, 2006, student gave a poster presentation
- Sigma Xi Annual Meeting and Students Research Conference, Detroit, MI, November 2-5, 2006
- The Great Lakes Chinese American Chemical Society (CACS) 10th Annual Conference at Northwestern University, Chicago, IL, May 13, 2006
- The ACS Indiana Section Meeting on ACS Progress for Women Chemists and Chemical Engineers, at the Lilly Corporate Center, Indianapolis, IN, April 11, 2006
- The 229th ACS National Meeting, San Diego, CA, March 13-17, 2005, gave a poster presentation

- The 2004 Midwest Regional ACS Meeting, Manhattan, KS, Oct 20-22, 2004, gave a poster presentation
- The 15th Midwest Organic Solid-State Chemistry Symposium (MOSSCS XV), Carbondale, IL, June 4-6, 2004, gave a poster presentation
- The 227th ACS National Meeting, Anaheim, CA, March 27-April 1, 2004, gave a poster presentation
- The 225th ACS National Meeting, New Orleans, LA, March 23-27, 2003, gave an oral presentation
- PITTCON, Orlando, FL, March 9-14, 2003
- The 222nd ACS National Meeting, Chicago, IL, August 26-30, 2001

**Professional Society Affiliation**

- Member of American Chemical Society (Since 2000)
- Member of Chinese American Chemical Society (Since 2005)
- Member of Sigma Xi, the Scientific Research Society (Since 2006)
- Member of COACh (Committee On the Advancement of Women Chemists) (Since 2006)
- Member of Indiana Academy of Science (Since 2007)
- Member of Hoosier Association of Science Teaching, Inc. (HASTI) (Since 2008)

**VI. Publications** (The names of the undergraduate co-authors are underlined.)

**Xie, Songwen**; Stein, Holly J.; Pink, Maren. 2,6-Dimethyl-4-*m*-tolylcyclohex-3-enecarboxylic acid. *Acta Crystallographica,* **2008**, E64, o1869.

**Xie, Songwen**; O'Hearn, Caryn R.; Robinson, Paul D. Racemic 4-(4-*tert*-butylphenyl)-2,6-dimethylcyclohex-3-enecarboxylic acid**.** *Acta Crystallographica,* **2008**, E64, o554.

**Xie, Songwen**; Kenny, Colin; Robinson, Paul D. Racemic 5-ethyl-2,6-dimethyl-4-*p*-tolyl-3-cyclohexenecarboxylic acid: an RS dimer. *Acta Crystallographica,* **2007**, E63, o3897.

**Xie, Songwen**; Kenny, Colin; Robinson, Paul D. 2,6-Dimethyl-4-oxocyclohexanecarboxylic acid: a meso keto acid. *Acta Crystallographica,* **2007**, E63, o1660-o1662.

**Xie, Songwen**; Lu, Qi. Crystal Engineering – the recognition at a molecular level. *CACS Communications*, Spring **2007**, 21-23.

**Xie, Songwen**. Synthesis, diastereomer identification and enantiomer resolution of non-steroidal estrogenic carboxylic acids and lactones for a structure-activity correlation study. Ph.D. Dissertation, **2005**, 218 pp.

Bektesevic, Selma; Beier, Julie C.; Chen, Liang; Eghbali, Nicolas; King, Stephanie; Levitin, Galit; Mehta, Geeta; Mullins, Richard J.; Reiner, Jessica L.; Weikel, Ross; **Xie, Songwen**; Gunn, Erica. Green challenges: student perspectives from the 2004 ACS-PRF Summer School on Green Chemistry. *Green Chem.* **2005**, 7, 403-407.

**Xie, Songwen**; Meyers, Cal Y.; Robinson, Paul D. N,N'-Dicyclohexyl-N-[(1RS,2RS,6SR)-4-(4-methoxyphenyl)-2,6-dimethyl-3-cyclohexene-1-carbonyl]urea: an unusual crystalline enantiomeric pairing. *Acta Crystallographica,* **2004**, E60 (4), o1361-o1363.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. (+/-)-5-Ethyl-endo-4-(4-methoxyphenyl)-2,2,anti-8-trimethyl-6-oxabicyclo[3.2.1]octan-7-one, a bicyclic g-lactone. *Acta Crystallographica,* **2003**, E59 (4), o406-o407.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. (+/-)-anti-7-Ethyl-1-(4-methoxyphenyl)-5,5,syn-8-trimethyl-2-oxabicyclo[2.2.2]octan-3-one, a bicyclic d-lactone. *Acta Crystallographica,* **2003**, E59 (4), o403-o405.

Meyers, Cal Y.; Chan-Yu-King, Roch; Hua, Duy H.; Kolb, Vera M.; Matthews, Walter S.; Parady, Thomas E.; Horii, Toyokazu; Sandrock, Paul B.; Hou, Yuqing; **Xie, Songwen**. Unexpected Differences in the a-Halogenation and Related Reactivity of Sulfones with Perhaloalkanes in KOH-t-BuOH. *Journal of Organic Chemistry* **2003**, 68(2), 500-511.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. 2(S),6(R)-Dimethyl-4-(4-methoxyphenyl)-5(R)-ethyl-3-cyclohexene-1(S)-carboxylic acid and its enantiomer: potential therapeutic agents for prostate cancer. *Acta Crystallographica,* **2002**, E58 (12), o1460-o1462.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. trans-3-Ethyl-cis-2,6,6-trimethyl-4-oxocyclohexanecarboxylic acid: an intermediate in the synthesis of a highly potent estrogen. *Acta Crystallographica, Section C: Crystal Structure Communications* **2002**, C58 (3), o159-o161.

Robinson, Paul D.; Sandrock, Paul; **Xie, Songwen**; Meyers, Cal Y. 2-Bromo-2-propyl 2-(5-tert-butyl-1,3-xylyl) ketone. *Acta Crystallographica,* **2001**, E57 (6), o555-o557.

Chen, Jiahua; Zou, Feng; Wang, Nengdong; **Xie, Songwen**; Zhang, Xiu. Production and application of LPA polyclonal antibody. *Bioorganic and Medicinal Chemistry Letters* **2000**, 10(15), 1691-1693.

*Non-referenced publications*

**Xie, Songwen**. The Unique Ho-Purdue Yeast – A Biography of Dr. Nancy W. Y. Ho. *CACS Communications*, Fall **2008**, 37-40.

**Xie, Songwen**. Expert of Particle Science -- A Biography of Dr. Jesse Zhu. *CACS Communications*, Spring **2008**, 39-43.

**Xie, Songwen**. Ambassador for Science, Technology, and Education -- A Biography of Dr. Marinda Li Wu. *CACS Communications*, Fall **2007**, 42-44.

**Xie, Songwen**. Professor Winston Ho – Member of the National Academy of Engineering, USA. *CACS Communications*, Spring **2007**, 36-38.

**Xie, Songwen**. Father's Road. (in Chinese) Page156-261 in *Commentary on Xie, Benshu's History Study*. Ed. by Cao, Weiqiong and Wu, Dade. Guizhou People's Publisher, PR China, April **2006**. ISBN 7-221-07322-8

**VII. Presentations** (The names of the undergraduate co-authors are underlined.)

Holly J. Stein; **Xie, Songwen***. *Meta* substituted 2,6-dimethyl-4-phenylcyclohex-3-enecarboxylic acids and their amide derivatives: a study on the interaction of enantiomers in solid state. Abstracts of Papers, Indiana Academy of Science 125th Fall Meeting, Indiana University Kokomo, IN, United States, October 22-23, **2009**.

**Xie, Songwen***. Double the Chances to Develop Students' Collaboration Skills: Wikis and Team-Based Learning. Abstracts of Papers, 238th ACS National Meeting, Washington, DC, United States, August 16-20, **2009**. CHED-102.

Holly J. Stein; **Xie, Songwen***. *Meta* substituted 2,6-dimethyl-4-phenylcyclohex-3-enecarboxylic acids and their amide derivatives: a study on the interaction of enantiomers in solid state. Abstracts of Papers, 237th ACS National Meeting, Salt Lake City, UT, United States, March 22-26, **2009**. ORGN-396.

Holly J. Stein; **Xie, Songwen***. *Meta* substituted 2,6-dimethyl-4-phenylcyclohex-3-enecarboxylic acids and their amide derivatives: a study on the interaction of enantiomers in solid state. The 2nd Annual Indiana University Kokomo Junior and Senior Student Symposium, Kokomo, IN, February 18-19, **2009**.

Holly J. Stein; **Xie, Songwen***. *Meta* substituted 2,6-dimethyl-4-phenylcyclohex-3-enecarboxylic acids and their amide derivatives: a study on the interaction of enantiomers in solid state. Abstracts of Papers, 14th Indiana University Undergraduate Research Conference, Indiana University Kokomo, Kokomo, IN, November 21, **2008**.

Holly J. Stein; **Xie, Songwen***. *Meta* substituted 2,6-dimethyl-4-phenylcyclohex-3-enecarboxylic acids and their amide derivatives: a study on the interaction of enantiomers in solid state. 9th Annual Indiana Local Section American Chemical Society Poster Session, Ball State University, Muncie, IN, October 16, **2008**.

**Xie, Songwen**. Double the chances to develop students' collaboration skills - Wiki and team based learning. 2nd IU Kokomo Faculty Conference, Kokomo, IN, May 30, **2008**.

**Xie, Songwen**. Team-based learning in chemistry. 2nd IU Kokomo Faculty Conference, Kokomo, IN, May 30, **2008**.

**Xie, Songwen**. Team-based learning in chemistry. Abstracts of Papers, 235th ACS National Meeting, New Orleans, LA, United States, April 6-10, **2008**. CHED-1598.

Holly J. Stein; **Xie, Songwen***. Synthesis of 2,6-dimethyl-4-*m*-substituted phenyl-3-cyclohexenecarboxylic acids. Abstracts of Papers, 235th ACS National Meeting, New Orleans, LA, United States, April 6-10, **2008**. CHED-473.

Caryn R. O'Hearn; **Xie, Songwen***. Synthesis and characterization of 2,6-dimethyl-4-*p*-substituted phenyl-3-cyclohexenecarboxylic acids. Abstracts of Papers, 235th ACS National Meeting, New Orleans, LA, United States, April 6-10, **2008**. CHED-460.

Holly J. Stein; **Xie, Songwen***. Synthesis of 2,6-dimethyl-4-*m*-methylphenyl-3-cyclohexenecarboxylic acid. The First Annual Indiana University Kokomo Junior and Senior Student Symposium, Kokomo, IN, February 20-21, **2008**.

Caryn R. O'Hearn; **Xie, Songwen***. Synthesis of 2,6-dimethyl-4-*p*-substituted phenyl-3-cyclohexenecarboxylic acids. The First Annual Indiana University Kokomo Junior and Senior Student Symposium, Kokomo, IN, February 20-21, **2008**.

Holly J. Stein; **Xie, Songwen***. Synthesis of 2,6-dimethyl-4-*m*-methylphenyl-3-cyclohexenecarboxylic acids. Abstracts of Papers, 13th Indiana University Undergraduate Research Conference, Indiana University Southeast, New Albany, IN, United States, November 30, **2007**. Poster 10.

Caryn R. O'Hearn; **Xie, Songwen***. Synthesis and characterization of 2,6-dimethyl-4-*p*-ethylphenyl-3-cyclohexenecarboxylic acids. Abstracts of Papers, 13th Indiana University Undergraduate Research Conference, Indiana University Southeast, New Albany, IN, United States, November 30, **2007**. Poster 9.

**Xie, Songwen***; Kenny, Colin M. Synthesis and characterization of 5-ethyl-2,6-dimethyl-4-p-tolyl-3-cyclohexenecarboxylic acid and its derivatives. 8th Annual Indiana Local Section American Chemical Society Poster Session, at the Lilly Corporate Center, Indianapolis, IN, October 11, **2007**. Poster 39.

**Xie, Songwen**. Design and synthesis of unique racemic carboxylic acids and their crystalline structure characterization: a study of the pseudo superimposition in X-ray crystallography. The 39th Course, Engineering of Crystalline Materials Properties: State-of-the-art in Modeling, Design, and Applications, Erice, Sicily, Italy, June 7-17, **2007**. This was an invited talk.

**Xie, Songwen**. Advice for international faculty to teach American students chemistry. Abstracts of Papers, 233rd ACS National Meeting, Chicago, IL, United States, March 25-29, **2007**. CHED-1812. This oral presentation was highlighted by *Chemical and Engineering News*, April 16, 2007, page 52.

Kenny, Colin M.; **Xie, Songwen***. Synthesis and characterization of 2,6-dimethyl-4-phenyl-3-cyclohexenecarboxylic acid and its derivatives, unusual enantiomeric pairs that differ only in the position of the double bond. Abstracts of Papers, 233rd ACS National Meeting, Chicago, IL, United States, March 25-29, **2007**. CHED-772.

Kenny, Colin M.; **Xie, Songwen***. Five-step synthesis of 2,6-dimethyl-4-phenyl-3-cyclohexenecarboxylic acid, unusual enantiomeric pairs. Abstracts of Papers, 12th Indiana University Undergraduate Research Conference, Indiana University - Purdue University Indianapolis, IN, United States, November 17, **2006**. Poster 14.

Meyers, Cal Y.; **Xie, Songwen**; Hou, Yuqing; McLean, Aaron W.; Murphy, Laura; Adler, Stuart; Winters, Todd; Henry; Nancy; Ellis, Stefanie; Robinson, Paul; Rath, Nigam P. Non-steroidal compounds that reduce prostate-cancer cell proliferation with little or no feminizing effect. Abstracts of Papers, 40th Midwest Regional Meeting of the ACS, Joplin, MO, United States, October 26-29, **2005**. LIN05-195.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y. Synthesis, diastereomer identification and enantiomer resolution of non-steroidal estrogenic carboxylic acids for in-depth structure-physiology correlation study. Abstracts of Papers, 229th ACS National Meeting, San Diego, CA, United States, March 13 - 17, **2005**. ORGN-799.

**Xie, Songwen**; Meyers, Cal Y.; Robinson, Paul D. Unusual enantiomers that differ only in the position of their double bond, and whose crystalline forms appear to be superimposed onto each other. Abstracts of Papers, The 2004 Midwest Regional ACS Meeting, Manhattan, KS, United States, Oct 20-22, **2004**, 116.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. Using X-ray crystallography to study the absolute structures of biologically active organic molecules. Abstracts of Papers, 15th Midwest Organic Solid-State Chemistry Symposium (MOSSCS XV), Carbondale, IL, United States, June 4-6, **2004**, Poster 9.

**Xie, Songwen**; Murphy, Laura L.; Henry, Nancy; Hou, Yuqing; Meyers, Cal Y. Syntheses and resolution of small estrogenic carboxylic acids and lactones for PC-3 and MCF-7 cell-line studies. Abstracts of Papers, 227th ACS National Meeting, Anaheim, CA, United States, March 27-April 1, **2004**, MEDI-238.

**Xie, Songwen**; Hou, Yuqing; Meyers, Cal Y.; Robinson, Paul D. Syntheses of small estrogenic carboxylic acids for a study of their *in vivo* and *in vitro* activities. Abstracts of Papers, 225th ACS National Meeting, New Orleans, LA, United States, March 23-27, **2003**, ORGN-633.

Hou, Yuqing; **Xie, Songwen**; Sandrock, Paul B.; Meyers, Cal Y. Unexpected reduction of the carbonyl group of aromatic ketones and aldehydes by vinyl Grignard reagents. Abstracts of Papers, 222nd ACS National Meeting, Chicago, IL, United States, August 26-30, **2001**, ORGN-447.

Meyers, Cal Y.; Parady, Thomas E.; Chan-Yu-King, Roch; Sandrock, Paul B.; **Xie, Songwen**; Hou, Yuqing; Hua, Duy H.; Robinson, Paul D. Enigma of rotational disorder in 2-halo-2-propyl (a-haloisopropyl) groups in their crystalline compounds. Abstracts of Papers, 222nd ACS National Meeting, Chicago, IL, United States, August 26-30, **2001**, ORGN-441.

* The names of the undergraduate co-authors are underlined.

## III. Faculty Member: SARA M. DEYO, Chemistry Laboratory Supervisor

**Education**

1973 B.S. Chemistry, Bob Jones University

1976 M.S. Natural Products Chemistry, Ohio State University

**Professional Experience**

1988 – Present: Chemistry Laboratory Supervisor Indiana University Kokomo

**Responsibilities**

**Instructional**

CHEM-C 102 Elementary Chemistry Lecture

CHEM-C 120 World of Chemistry Lab

CHEM-C 121, CHEM-C 122 Elementary Chemistry Labs

CHEM-C 125, CHEM-C 126 General Chemistry Labs

CHEM-C 483 Biochemistry Lecture

Duties for laboratory classes include syllabus preparation, lab manual preparation, pre-laboratory lecture, laboratory supervision, grading of lab reports, preparation and grading of tests.

Duties for lecture classes include syllabus preparation, text selection, class lectures, preparation and grading of tests.

**Health and Safety**

Writing and maintaining the Chemical Health and Safety Plan

Overseeing disposal of laboratory waste

Maintaining MSDS files for department

**Other**

Prepping all chemistry labs

Ordering and maintaining supplies and equipment

Supervising part time student employee

**Professional Training**

Aug 1989: 1-day Lab Safety Workshop sponsored by Curry College

June 1990: Week-long Workshop for Microscale Organic Techniques conducted by Dr. Ken Williamson, Mt. Holyoke College

Feb 1991: 1-day Workshop dealing with new OSHA Laboratory Safety Standard sponsored by IU South Bend

Sept, 1991: Two day conference for Health and Safety Directors, sponsored by the IU Dept. of Health and Safety

Oct 1991: Received Red Cross CPR Certification

June 1998: NSF Chautauqua Short Course: Biotechnology for Interdisciplinary Science

June 1999: NSF Chautauqua Short Course: Biotechnology Theory and Practice for the 21st Century

July 2002: NSF Chautauqua Short Course: Bridging the Gap Between Undergraduate Science and Health Professions: Applications of General and Organic Chemistry to Medicinal and Pharmaceutical Chemistry

## IV. Faculty Member: **MARCIA L. GILLETTE,** Senior Lecturer in Chemistry

**Education:**

1967 Ph.D. (Analytical Chemistry) Iowa State University, Ames, IA

1965 M.S. (Analytical Chemistry) Iowa State University, Ames, IA

1963 A.B. (Chemistry) Mount Holyoke College, South Hadley, MA

**Professional Experience:**

Indiana University Kokomo, Kokomo, IN

Senior Lecturer in Chemistry

Fall, 2002: Lecturer in Chemistry (full-time position)

1983-2002: Lecturer in Chemistry (half-time position)

1976-1983: Adjunct faculty member

Lectures taught: CHEM-C 100, CHEM-C 101, CHEM-C 102, CHEM-C 105, CHEM-C 106, CHEM-C 310, CHEM-C 341, CHEM-C 342, CHEM-C390, COAS-E 104, COAS-E 105, COAS-S 104

Laboratories taught: CHEM-C 120, CHEM-C 121, CHEM-C 125, CHEM-C 126, CHEM-C 315

Supervision of student research: C490 (Fall 2002)

Chemical Education Resources, Inc. (Since 1999, part of the Brooks/Cole division of Thomson Learning) 1989-2004: Revisions Editor and Introductory Chemistry Editor

**Grants Received:**

1996: NSF-ILI grant (DUE-9650087), "*Making Real-Life Connections for Non-Majors Studying the World of Chemistry"* ($8,876).

1996: Indiana University Strategic Directions Initiative grant (SDC Proposal #1996-186), "*Making Interesting, Real-Life Connections for Non-Majors Studying the World of Chemistry"* was approved for funding ($8,876).

The monies from these grants was used to purchase laboratory equipment (bomb calorimeters and Kjeldahl apparatus) for use in a new, nonmajors chemistry laboratory course, CHEM C120, as well as in other laboratory courses.

**PRESENTATIONS:**

"Chemistry Laboratory Research Projects in Context" involving a description of the C120 curriculum with emphasis on the research projects the C120 students perform as part of a symposium entitled "*Chemistry in Context*: Variation on a Theme" at the 16th Biennial Conference on Chemical Education at the University of Michigan in Ann Arbor, August 1, 2000.

With Kathy Parkison, Ann Cameron, and Gail MacKay, "Launching a New Interdisciplinary Freshman Year Program" 18th Annual Spring Symposium at Indiana University Bloomington. April 7, 2000.

With Kathy Parkison and Ann Cameron "Teaching and Learning Communities: Providing Context for Freshman English and Speech Courses". Ball State University Conference on the Scholarship of Teaching and Learning. March 18, 2000

"Using a Microscale Experiment to Teach Critical Thinking and Chemical Logic" at the Hoosier Association of Science Teachers, Inc. (HASTI) convention in Indianapolis on February 12, 1993. This paper described the usefulness of the analysis of data collected for a chemical system for teaching fundamental chemical concepts associated with stoichiometry, the quantities of reactants and products involved in chemical reactions.

"Quantitative Considerations in Microscale Experiments. A Study of the Stoichiometry of the Reaction of Nickel(II) Nitrate and Sodium Hydroxide" a paper presented on August 29, 1990 at the 200th National Meeting of the American Chemical Society in Washington, D.C. as part of a symposium on microscale experiments for general chemistry courses. This work was done in cooperation of H. Anthony Neidig of Lebanon Valley College and Chemical Education Resources.

"Development of and Expectations From A Microscale Experiment for the Determination of the $K_a$ of a Weak Acid" a paper presented on August 8, 1990 at the 11th Biennial Conference on Chemical Education in Atlanta, Georgia. This work was done in cooperation of H. Anthony Neidig of Lebanon Valley College and Chemical Education Resources.

With Diana Hunn (IUK Education Department), a workshop describing methods for teaching science to handicapped (particularly vision impaired) students. Hoosier Association of Science Teachers Inc. (HASTI) convention, Indianapolis, IN, February, 1989.

**Publications:**

The following are laboratory separates published by Chemical Education Resources, Inc.

*Molar Mass Determination by Freezing-Point Depression in t-Butyl Alcohol*, by M.L. Gillette and S.R. Johnson (PROP 344).

*The Visible Atomic Spectrum of Hydrogen*, by M.L. Gillette and S.R. Johnson (STRC 345).

*Spectrophotometric Studies of Food Dye Solutions*, by M.L. Gillette and H.A. Neidig (ANAL 361)

*Introducing Graphing Techniques*, by M.L. Gillette and H. Anthony Neidig (MISC 371).

*Determining the Dissociation Constant of a Weak Acid Using pH Measurements*, by Donald C. Raney and M.L. Gillette (EQUL 376).

*Detecting Signs of Chemical Change*, by M.L. Gillette and H.A. Neidig (REAC 399).

*Estimating the Solubility Product Constant of Strontium Iodate Using Microscale Techniques*, by M.L. Gillette and H. Anthony Neidig (EQUL 400).

*Studying the Stoichiometry of the Reaction of Nickel(II) Ion and Hydroxide Ion Using Microscale Techniques*, by M.L. Gillette and H. Anthony Neidig (STOI 401).

*Evaluating the Dissociation Constant of a Weak Acid Using Microscale Techniques*, by M.L. Gillette and H. Anthony Neidig (EQUL 402).

*Studying Chemical Equilibria and Applying LeChatelier's Principle Using Microscale Techniques*, by M.L. Gillette and H. Anthony Neidig (EQUL 404).

*Identifying Six Solutions by their Interactions*, by H. Anthony Neidig, J. Iskowitz, and M.L. Gillette (REAC 405).

*Writing Chemical Equations and Identifying Unknown Solutions Using Microscale Techniques*, by M.L. Gillette and H.A. Neidig (REAC 406).

*Studying Boyle's Law*, by J.N. Spencer and M.L. Gillette (PROP 410).

*Determining the Comparative Reactivities of Several Metals*, by M.L. Gillette and H.A. Neidig (REAC 414).

*Studying Chemical Reactions and Writing Chemical Equations*, by M.L. Gillette and H. Anthony Neidig (REAC 422).

*Synthesizing Alum*, by Marcia Gillette and H. Anthony Neidig (SYNT 451).

*Synthesizing Alum and Observing Some Chemistry of Aluminum*, by Marcia Gillette and H. Anthony Neidig (SYNT 452).

*Determining the Equivalent Mass and Dissociation Constant of an Unknown Weak Acid by Titrimetry*, by Richard C. Bell and M.L. Gillette (EQUL 453).

*Separating and Determining the Mass of Calcium Ion in a Calcium-Enriched Tablet*, by M.L. Gillette and H.A. Neidig (ANAL 455).

*Studying Oxidation-Reduction Reactions*, by Marcia Gillette and H. Anthony Neidig (REAC 456).

*Balancing Oxidation-Reduction Equations Using the Oxidation Number Method*, by Marcia Gillette and H. Anthony Neidig (MISC 457).

*Balancing Oxidation-Reduction Equations Using the Ion-Electron Method*, by Marcia Gillette, and H. Anthony Neidig (MISC 458).

*Naming Inorganic Compounds*, by Marcia Gillette, and H. Anthony Neidig (MISC 459).

*Separating and Isolating the Components of a Binary System*, by Marcia Gillette and H. Anthony Neidig (PROP 460).

*Separating and Isolating the Components of a Ternary System*, by Marcia Gillette and H. Anthony Neidig (PROP 461).

*Comparing the Resistance of Buffered and Unbuffered Solutions to pH Change*, by Marcia L. Gillette (EQUL 464).

*Using Acid-Base Indicators to Visually Estimate the pH of Solutions*, by Marcia L. Gillette (EQUL 465).

*Standardizing a Sodium Hydroxide Solution and Using It to Analyze Vinegar*, by Marcia L. Gillette (ANAL 466).

*Interpreting and Balancing Chemical Equations*, by M.L. Gillette and H.A. Neidig (MISC 476).

*Writing and Balancing Chemical Equations*, by M.L. Gillette and H.A. Neidig (MISC 477).

*Determining the Formula of an Ionic Hydrate Gravimetrically*, by Donald F. Clemens, Warren A. McAllistar, and M.L. Gillette (ANAL 479).

*A Sequence of Chemical Reactions: Transforming Copper*, by Guy B. Homman and M.L. Gillette (REAC 480).

*Determining the Molar Mass of a Volatile Liquid by the Dumas Method*, by John W. Alcock and M.L. Gillette (PROP 481).

*Copper from Start to Finish: A Sequence of Chemical Reactions*, by Guy B. Homman, Barton Houseman, and M.L. Gillette (REAC 482).

*Making and Using Visible Absorption Measurements*, by Norman E. Griswold and M.L. Gillette (TECH 488).

*Using a pH Meter*, by Norman E. Griswold and M.L. Gillette (TECH 469).

*Analyzing a Mixture of Sodium Hydrogen Carbonate and Sodium Chloride by Thermal Decomposition*, by John T. Yoke and M.L. Gillette (ANAL 493).

*Monitoring Acid-Base Titrations with a pH Meter*, by John W. Alcock and M.L. Gillette (EQUL 494).

*Approximating Avogadro's Number Using Glass Beads and Monomolecular Film*, by Don McMasters and M.L. Gillette (STOI 496).

*Studying the pH of Strong Acid, Weak Acid, Salt, and Buffer Solutions*, by Norma Robinson North and M.L. Gillette (EQUL 499).

*Establishing the Relative Reactivity of Halogens and Halide Ions*, by M.L. Gillette and H.A. Neidig (REAC 502).

*Studying the Rate of the Reaction of Potassium Permanganate and Oxalic Acid*, by Richard C. Bell and M.L. Gillette (KINE 505).

*Determining the Water Content of an Ionic Hydrate*, by Donald F. Clemens, Warren A. McAllister, Marcia L. Gillette, and Henry d. Schreiber (ANAL 517).

*Introducing Mass and Volume Measurements*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (TECH 601).

*Determining Density*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (PROP 602).

*Resolving a Two-Component Mixture*, by M.L. Gillette, H. Anthony Neidig, J. Iskowitz, and M. Royer (PROP 603).

*Observing Signs of Chemical Reaction* by M.L. Gillette and H. Anthony Neidig (REAC 604).

*Determining the Percent Water in an Unknown Hydrate*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (ANAL 605).

*Determining the Empirical Formula of Magnesium Oxide*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (STOI 606).

*Reacting Vinegar with Baking Soda to Find Percent Acetic Acid*, by Henry D. Schreiber and M.L. Gillette (STOI 607).

*Estimating a Heat of Neutralization*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (THER 609).

*Observing Single Replacement Reactions*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (REAC 610).

*Observing Double Replacement Reactions*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (REAC 611).

*Preparing Alum*, by M.L. Gillette and H.A. Neidig (SYNT 612).

*Classifying Some Chemical Reactions*, by M.L. Gillette and H.A. Neidig (REAC 613).

*Writing, Interpreting, and Balancing Chemical Equations*, by M.L. Gillette and H.A. Neidig, (MISC 614).

*Studying Some Aspects of Solubility*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (PROP 615).

*Introducing Chemical Equilibrium*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (EQUL 616).

*Estimating the pH of some Solutions Using Visual Indicators*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (EQUL 617).

*Standardizing a Sodium Hydroxide Solutions*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (ANAL 618).

*Titrating the Acetic Acid in Vinegar*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (ANAL 619).

*Separating and Identifying FD&C Dyes Using Paper Chromatography*, by Peter Markow, and M.L. Gillette (ANAL 620).

*Isolating the Components of a Three-Component Mixture*, by H.A. Neidig, J. Iskowitz, M. Royer, and M.L. Gillette (PROP 621).

*Analyzing the Vitamin C in Fruit Juices*, by M.L. Gillette, Roberta G. Reed, and John C. Kotz (ANAL 622).

*Estimating the Calorie Content of Peanuts*, by Peter Markow and M.L. Gillette (THER 623).

*Identifying Cations in a Solution*, by H.A. Neidig, J.N. Spencer, and M.L. Gillette (ANAL 624).

*Estimating the Acid Content of Fruit Juices*, by Andrew W. Zanella and M.L. Gillette (ANAL 625).

*Observing Some Oxidation-Reduction Reactions*, by M.L. Gillette and H.A. Neidig (REAC 626).

*Observing Some Physical and Chemical Changes in Matter*, by Grover W. Everett, Grover W. Everett Jr., and M.L. Gillette (PROP 627).

*Preparing Aspirin*, by M.L. Gillette and Robert L. Glogovsky (SYNT 628).

*Naming Inorganic Chemical Substances*, by M.L. Gillette and H.A. Neidig (MISC 629).

*Visualizing Chemical Structures Using Lewis Models*, by M.L. Gillette, H.A. Neidig, and J.N. Spencer (STRC 631).

*Determining the Empirical Formula of a Compound Containing Copper and Chlorine*, by M.L. Gillette and Don Stafford (STOI 633).

*Identifying Solutions of Ionic Compounds*, by H.A. Neidig, J. Iskowitz, and M.L. Gillette, (REAC 634).

*Discovering Some Periodic Properties of Elements*, by John Woolcock and M.L. Gillette (REAC 635).

*Solving Stoichiometric Problems*, by M.L. Gillette (MISC 636).

*Identifying a Weak Acid by Titrimetry*, by R.C. Bell, M.L. Gillette, and J.R. Crook (EQUL 853, 855, 857, 859).

*Acid-Base Titration Curves*, by J.W. Alcock, M.L. Gillette, and J.R. Crook (EQUL 865, 867, 869, 871).

*Introduction to Computer-Based Graphical Analysis*, by M.L. Gillette, H.A. Neidig, and J.R. Crook (MISC 873-877).

*Molar Mass Determination by Freezing-Point Depression*, by M.L. Gillette, S.R. Johnson, and J.R. Crook (PROP 878, 880, 882).

*Introducing IUPAC Nomenclature for Organic Chemical Compounds* by M.L. Gillette (MISC 639)

**Memberships in Professional Organizations:**

American Chemical Society (ACS)

Chemical Education Division of the American Chemical Society

Indiana Academy of Science (IAS)

Hoosier Association of Science Teachers Inc. (HASTI)

## Appendix 2: Service Record of Chemistry Faculty Since 2003

**Dr. Kasem K. Kasem,** Professor of Chemistry

**Committee Work**

- P&T (2004/2005 , 2008/2009/2010
- Faculty Affair Committee (4 years)
- Budgetary affair committee
- Research affair committee (Chair)

**Service Work Other Than Committees:**

1. Moderated sessions at international conference for Energy (EGYPT) 2007/2009.
2. Moderated sessions at IUURC 2007/2008.
3. Delivered talks to the Kokomo community about energy.

**Reviewed**

- One article for *Journal of Electroanalytical Chemistry*
- Three articles for *Journal of Chemical Education*
- One article for the *Journal of Bio-Technology*
- One article for *Organic Metals*
- One article for *Biophysics*
- Two research proposals for USA Department of State

**Dr. Songwen Xie,** Assistant Professor of Chemistry

**Committee Work**

- Search and Screen Committee for Assistant Professor of Biology, Indiana University Kokomo, Member, 2009-2010
- Faculty Senate Graduate Programs Committee, Indiana University Kokomo, Member, 2008-2010
- Faculty Senate Academic Calendar Committee, Indiana University Kokomo, Member, 2006-2008

- Search and Screen Committee for Assistant Professor of Biology and Assistant Professor of Physics, Indiana University Kokomo, Member, 2007-2008
- Search and Screen Committee for Director for Admissions and Scholarships and Financial Aid, Indiana University Kokomo, Member, 2007
- Faculty Board of Review Committee, Indiana University Kokomo, Member, 2006-2007, 2008-2009
- Faculty advisor for Science/Math Club, Indiana University Kokomo, 2006-2007
- Search and Screen Committee for Lecturers of Mathematics, Indiana University Kokomo, Member, 2006-2007
- Search and Screen Committee for Assistant Professor of Informatics, Indiana University Kokomo, Member, 2005-2006

**External Professional Service**

- Career consultant, American Chemical Society (ACS) Career Services, since 2008
- **Editor** of *CACS Communications* (ISBN 1939-4004), Chinese American Chemical Society (CACS), 2006-2010
- Facilitator to chair an oral presentation session at the 12$^{th}$ Indiana University Undergraduate Research Conference, November 17, 2006, Indiana University - Purdue University Indianapolis, IN.
- Judge for Chemistry at Sigma Xi Annual Meeting and Student Research Conference, November 2-5, 2006, Detroit, MI
- Grand Awards Judge for Chemistry at Intel 2006 International Science and Engineering Fair, May 7-13, 2006, Indianapolis, IN
- Manuscript Reviewer for the following peer-reviewed publication

  -Journal of Agricultural and Food Chemistry (ACS), one paper reviewed, 2006

**Community Service**

- **Chair**, Scholarship committee for Delphi DECN/KCA (Kokomo Chinese Association) Scholarship for young students for excellence, 2006-2009
- Judge of 2009 Howard County Science Fair, IU Kokomo, February 21, 2009
- Judge of 2008 Howard County Science Fair, IU Kokomo, February 16, 2008
- Judge of 2007 Howard County Science Fair, IU Kokomo, February 17, 2007
- Judge of 2006 Howard County Science Fair, IU Kokomo, February 11, 2006
- Proctor of the 2006 State High School Mathematics Contest, IU Kokomo, April 22, 2006

**Sara Deyo M.S.,** Chemistry Laboratory Supervisor

**Committee Work**

- University Wide Laboratory Safety Committee, Spring 2008-present
- Campus Safety Committee, Spring 2008-present
- Search and Screen Committee for Assistant Professor of Biology and Assistant Professor of Physics, Indiana University Kokomo, Member, 2007-2008

**Community Service**

- Judge of Howard County Science Fair, IU Kokomo, Spring of 2003, 2004, 2005, 2007, 2008, 2009
- Judge of Maconaquah Middle School Science Fair, Spring of 2003, 2004, 2005, 2007
- Supervised student research for science fair project using chemistry department spectroscopes, Spring 2007, 2008, 2009
- Presentation to Middle School Career Day, Spring of 2003-2007

**Other**

- Reviewed Chapters 1-5 of Suchoki, Conceptual Chemistry, 4/e, for Pearson Ed. Inc, May, 2009

**Dr. Marcia L. Gillette,** Senior Lecturer in Chemistry

**Committee Work**

- Faculty Senate Admissions Committee: 2003, Chairperson 2004-2008, 2009
- Arts and Sciences Academic Affairs Committee: 2003
- Arts and Sciences Admission Committee: 2003-2009
- Arts and Sciences General Education Committee: 2003-2006
- Reclassification Committee: 2003-2009
- Scholarship Committee: Chairperson 2003-2009
- Parking Appeals Committee: 2003-2009
- Trustee Teaching Awards Committee: 2003, 2004, 2005 (Chairperson)
- Art Gallery Faculty Advisory Board: 2003-2008
- Staff Council Scholarship Committee: 2004-2006
- Administrative Review Committee: 2004-2008
- Kresge Challenge Initiative Committees: 2003-2005
- Administrative Performance Review Committees: 2003, 2008, 2009
- IU Kokomo's 60th Year of Service Committee: Co-chair, 2004-2006
- Strategic Planning Action Team: 2006-2008
- United Way Campaign: Co-Chair 2007
- Faculty Advisory Committee for General Studies/Accelerated Evening College: 2009
- Allied Health Advisory Committee: 2009
- Foundations of Excellence, Faculty Dimension Committee: 2009

- Search and Screen Committees: 2003 (2), 2004 (2), 2005 (5), 2006 (3), 2007 (4), 2008 (4), 2009 (2)

**Community and Professional Service**

- Member of the Indiana Science Education Alliance: 2003, 2004
- Directed the Indiana Academy of Science Talent Search, held at IU Kokomo: 2003-2009
- Member of the Indiana Academy of Science Fellowship Awards Committee: 2003-2009
- Member of the American Chemical Society Examinations Institute *Chemistry in Context* Examination Committee: 2004-2007
- Made presentations about using case studies to participants in VISION: 2003-2009
- Represented Chemists at Welcome to the Real World presentations to local middle school students: 2003-2009
- Coordination arrangements for the Howard County Science Fair: 2003-2009
- Judged at local elementary and high school science fairs: 2003-2009
- Judged at the East-Central Regional Science Fair held at Ball State University: 2003-2009
- Coordinated arrangements for the 2004 Hoosier Science and Engineering Fair, held at IU Kokomo: 2004
- Judged at the Hoosier Science and Engineering Fairs: 2005, 2007, 2008, 2009
- Member of the Academies Committee for Taylor Township School Corporation: 2009
- Reviewed articles for the Journal of Chemical Education: 2006 (2), 2008 (2), 2009 (2)

# Appendix 3: Proposed Bachelor of Science in Chemistry Degree Requirements

**Proposed Curriculum.**

**a. General Education**

Communication (10 cr.) including ENG−W 131, ENG−W 132, SPCH−S 121, CSCI−C 100

Mathematics: Covered in the major. Students who place into lower than required-level courses will have to take additional preparatory courses, adding credit hours to their degrees.

Humanities (9 cr.) including: Literature (writing intensive), performance, and ethics classes.

Social & Behavioral Sciences (15 cr.) including HIST−H 113, HIST−H 114

Natural Sciences (13 cr.) including: BIOL−L 105, CHEM−C 105/125, and CHEM−C 106

**b. The Chemistry degree concentration (minimum of 64 cr. hr.).**

**c. The Capstone Experience in Chemistry (1 cr.)**

**d. Other requirements**

Courses counted toward the concentration must be taken for a letter grade; Students must maintain an overall GPA of 2.0 or higher.

**e. Summary of minimum requirements.**

| | |
|---|---|
| General Education | 47 credits |
| Major | 65 credits |
| Electives | 08 credits |
| Total | 120 credits |

**f. Sample Curriculum for the Bachelor of Science in Chemistry Degree:**

**Freshman Year**

**Fall Semester (15−17 cr.)**

CHEM-C 105: Principles of Chemistry I (3 cr.)

CHEM-C 125: Experimental Chemistry I (2 cr.)

BIOL-L 105: Introduction to Biology (5 cr.)

ENG-W 131: Elementary Composition I (3 cr.)

MATH-M 119: Brief Survey of Calculus I (3 cr.) **or** MATH-M 215: Calculus I (5 cr.)

**Spring Semester II (15−17 cr.)**

CHEM-C 106: Principles of Chemistry II (3 cr.)

CHEM-C 126: Experimental Chemistry II (2 cr.)

MATH-M 120: Brief Survey of Calculus II (3 cr.) **or** MATH-M 216 Calculus II (5 cr.)

ENG-W 132: Elementary Composition II (3 cr.)

SPCH-S 121: Public Speaking (3 cr.)

CSCI-C 100: Computing Tools (1 cr.)

**Sophomore Year**

**Fall Semester (16 cr.)**
CHEM-C 210: Introduction to Quantitative Analytical Chemistry (3 cr.)
CHEM-C 211: Introduction to Quantitative Analytical Chemistry Laboratory (2 cr.)
PHYS-P 201: General Physics I (5 cr.)
HIST-H 113: History of Western European Civilization I (3 cr.)
Social Science elective (3 cr.)

**Spring Semester (16 cr.)**
CHEM-C 310: Analytical Chemistry (3 cr.)
CHEM-C 311: Analytical Chemistry Laboratory (2 cr.)
PHYS-P 202: General Physics II (5 cr.)
HIST-H 114: History of Western European Civilization II (3 cr.)
Elective (3 cr.)

**Junior Year**

**Fall Semester (14 cr.)**
CHEM-C 341: Organic Chemistry I: Lecture (3 cr.)
CHEM-C 343: Organic Chemistry I: Laboratory (2 cr.)
PSY-K 300 **or** STAT 301: Statistics (3 cr.)
CHEM-C 430: Inorganic Chemistry **or** CHEM-C 361: Physical Chemistry I (3 cr.)
Performance class (3 cr.)

**Spring Semester (17 cr.)**
CHEM-C 342: Organic Chemistry II: Lecture (3 cr.)
CHEM-C 344: Organic Chemistry II: Laboratory (2 cr.)
CHEM-C 483: Biological Chemistry **or** CHEM-C 443: Organic Spectroscopy (3 cr.)
CSCI-C 106: Introduction to Computers and Their Use (3 cr.)
Ethics class (3 cr.)
Social Science elective (3 cr.)

**Senior Year**

**Fall Semester (16 cr. )**
CHEM-C 351: Green Chemistry and Sustainability Science (4 cr.)
CHEM-C 443: Organic Spectroscopy (3 cr.)
CHEM-C 409: Chemical Research (3 cr.)
CHEM-C 430: Inorganic Chemistry **or** CHEM-C 361: Physical Chemistry I (3 cr.)
Writing intensive 300/400-level literature course (3 cr.)

**Spring Semester (14 cr.)**
CHEM-C 400: Chemical Information Sources and Services (1 cr.)
CHEM-C 495: Capstone in Chemistry (1 cr.)
CHEM-C 409: Chemical Research (3 cr.)

CHEM-C 483: Biological Chemistry **or** CHEM-C 443: Organic Spectroscopy (3 cr.)
Elective (3 cr.)
Social Science elective (3 cr.)

Total = 123 cr.

**The courses currently offered are in the following rotation:**

Offered Every Semester

CHEM-C 409: Chemical Research

Offered Once a Year

CHEM-C 105/CHEM-C 125: Principles of Chemistry I and Laboratory (Fall)
CHEM-C 106/CHEM-C 126: Principles of Chemistry II and Laboratory (Spring)
CHEM-C 341/CHEM-C 343: Organic Chemistry I and Laboratory (Fall)
CHEM-C 342/CHEM-C 344: Organic Chemistry II and Laboratory (Spring)
CHEM-C 210/CHEM-C 211: Introduction to Quantitative Analytical Chemistry and Laboratory (Fall)
CHEM-C 310/CHEM-C 311 Analytical Chemistry and Laboratory (Spring)

Offered in Alternating Years

CHEM-C 351: Green Chemistry and Sustainability Science (Fall)
CHEM-C 361: Physical Chemistry I (Fall)
CHEM-C 400: Chemical Information Sources and Services (Spring)
CHEM-C 430: Inorganic Chemistry (Fall)
CHEM-C 443: Organic Spectroscopy (Spring)
CHEM-C 483: Biological Chemistry (Spring)
CHEM-C 495: Capstone in Chemistry (Spring)

# Appendix 4: Program Learning Outcomes and Assessment

**CHEMISTRY ASSESSMENT PLAN 2009 - 2010**

**March 4, 2009**

**I. MISSION**

The Bachelor of Arts degree in Chemistry is designed to provide students with the background needed for science-related industrial and academic positions, for entry into chemistry graduate programs or professional programs (for example: such as medicine, veterinary medicine, dentistry, optometry) and, coupled with the appropriate education courses, to prepare students to teach high school chemistry. The mission is consistent with the IU Kokomo Mission Statement.

**II. PROGRAM GOALS AND STUDENT LEARNING OUTCOMES**

**Student Learning Outcomes and Components**:

**Goal I:** Knowledge and understanding of the theoretical basis of chemistry.

Outcome 1: Students will be able to connect observations with prior information.

Components:

1. Prediction of chemical reaction products
2. Identification of chemical reaction products

Outcome 2: Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure.

Components:

1. Explanation of physical properties
2. Explanation of chemical properties

Outcome 3: Students will perform quantitative calculations using experimental data.

Components:

1. Selection of an appropriate theoretical relationship/equation for data analysis.
2. Completion of quantitative calculations
3. Explanation of the significance and/or validity of the results.

**Goal II: Laboratory Work and Performance**

Outcome 1: Students will demonstrate the understanding and ability to carry out laboratory procedures effectively and safely.

Components:

1. Explanation of the purpose of the steps in a laboratory procedure.
2. Use of standard laboratory equipment and instrumentation properly and safely.

Outcome 2: Students will collect, analyze, and draw relevant conclusions from experimental data.

Components:

1. Collection and organization of relevant data.

2. Analyze experimental data appropriately.
3. Interpretation of processed data.
4. Identification of experimental errors.

Outcome 3: Design procedures appropriate to the goal of an investigation.

Components:

1. Selection of a suitable experimental approach.
2. Modification of the approach to optimize the experimental outcome.

**Goal III: Application of Quantitative Reasoning Skills and Critical Thinking to Problem Solving**

Outcome 1: Students will learn to organize relevant information for analysis.

Components:

1. Identification of critical data elements necessary to understand the problem
2. Identification of applicable theories and/or mathematical relationships

Outcome 2: Students will calculate quantitative values and/or formulate an explanation of observations.

Components:

1. Application of theories to illustrate how observations can be understood
2. Application of equations to determine mathematical values with appropriate significant figures and units

Outcome 3: Students will draw conclusions from quantitative values and/or experimental observations.

Component:

Correlation of quantitative results to chemical and/or physical properties of the system.

**III. Curriculum Map**

| [Outcomes]<br><br>Student will: | C 105 General Chem I | C 106 General Chem II | C 125 Gen Chem Lab I | C 126 Gen Chem Lab II | C 210 Intro Analytical | C 211 Intro Anal Lab | C 310 Instrumental Anal | C 311 Instrumental Lab | C 341 Organic Lecture I | C 342 Organic Lecture II | C 343 Organic Lab I | C 344 Organic Lab II | C 351 Green Chemistry | C 361 Physical Chem | C 400 Chem Information | C 409 Research | C 430 Inorganic Chem | C 443 Org Spectroscopy | C 483 Biochemistry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connect observations with prior information | X | X | | X | | X | X | X | X | X | X | X | X | X | | | | X | |
| Explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure | X | X | X | | | | | | X | X | | X | X | | | | | X | X |
| Perform quantitative calculations using experimental data | X | X | X | X | | X | | | | | X | X | | | | | | | |
| Demonstrate the understanding and ability to carry out laboratory procedures effectively and safely | | | X | X | | X | X | X | | | X | X | X | | | X | | | |
| Collect, analyze, and draw relevant conclusions from experimental data | | | X | X | | X | X | X | | | | X | X | | | X | | X | |
| Design procedures appropriate to the goal of an | | | | | | X | X | X | | | | X | X | | | X | | X | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| investigation | | | | | | | | | | | | | | | | | | | |
| Organize relevant information for analysis | X | X | X | X | X | X | | | | X | X | X | | X | | X | | X | |
| Calculate quantitative values and/or formulate an explanation of observations | X | X | X | X | X | X | X | | | X | X | X | X | X | | | X | | |
| Draw conclusions from quantitative values and/or experimental observations | | | | X | X | X | X | | X | X | X | X | X | X | | X | | X | |
| Write effective laboratory reports | | | | X | | X | | X | | | X | X | | | | X | | | |
| Present written and oral summaries of scientific literature | | | | | | | | | | | | | | | X | X | X | X | |

**IV. Assessment of student learning activities planned for 2009-2010**

A. Learning outcomes to be assessed:
In 2009-2010, we plan to assess goal I (Knowledge and understanding of the theoretical basis of chemistry – Outcomes 1-3). We are particularly interested in measuring our strengths and weaknesses in helping our students to explain the physical and chemical properties of substances based on an understanding of the theoretical bases and to make the connection between observation and prior information, both in the context of the lecture and laboratory portions of our courses.

B-C. Activities and performance characteristics for each outcome/component to be assessed in 2009-2010.

We will assess these outcomes in the following courses:

| | CHEM-C 105 | CHEM-C 106 | CHEM-C 125/126 | CHEM-C 211 |
|---|---|---|---|---|
| **Outcomes** | Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure | Students will perform quantitative calculations using experimental data. | Students will perform quantitative calculations using experimental data | Students will perform quantitative calculations using experimental data |
| **Component(s)** | Explanation of physical and chemical properties | Selection of an appropriate theoretical relationship/equation for data analysis | Selection of an appropriate theoretical relationship/equation for data analysis | Completion of quantitative calculations; Explanation of the significance and/or validity of the results |
| **Activity(es)** | Exam question(s): Use periodic table to explain the properties of elements and compounds, such as electron configuration, ionization energy, and polarity. Use solubility rule to | Exam and quizzes questions that focus on explanation of some phenomena using the kinetic and thermodynamic aspects of chemical reactions. | **Completion of laboratory reports, including results and analysis of those results; two exams which include performing the types of calculations required in** | **Completion of laboratory reports, including results and statistical analysis of those results; Completion of laboratory final examination which includes selecting an appropriate analytical** | Exam and quizzes questions that focus on explanation of some phenomena using the kinetic and thermodynamic aspects of chemical reactions. | Exam questions American Chemical Society standardized exam (selected questions, such as the ones on the structures and activities on different types of organic | Exam question(s): Predict the major products for oxidation, reduction, and substitution reactions | Exam questions relating to the structure and function of the major biological molecules and their interactions |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | predict the solubility of compounds. | | **the experiments** | **method, processing data, and reporting on results.** | | compounds) | | |
| **Performance characteristics** | Correct/ partially correct/ incorrect | Correct/ partially correct/ incorrect | Correct/ partially correct/ incorrect | Correct/ partially correct/ incorrect | Correct/ partially correct/ incorrect | Correct/ incorrect | Correct/ partially correct/ incorrect | Correct/ partially correct/ incorrect |
| **Benchmark** | 70% correct | 70% correct | 70% correct | 70% correct | 70% correct | 70% correct | 70% correct | 70% correct |

In addition to conducting specific assessment of the learning outcomes in the courses as described above, the chemistry faculty members are also interested in an overall learning assessment of the graduating seniors. We propose to start compiling the following data in order to develop a historical profile of the chemistry graduates at IU Kokomo. This may include:

i. Initially, we considered administering the Educational Testing Service Major Field Test in Chemistry to our graduating chemistry majors. Since formulating that plan we have had an opportunity to examine the newly available Diagnostic of Undergraduate Chemistry Knowledge (DUCK) examination, an interdisciplinary exam within the field of chemistry created by the American Chemical Society Examinations Institute. According to an article by Tom Holme appearing in the Spring 2009 "CHED Newsletter" (p.9): "The committee who developed this exam essentially began from the "Big Ideas" that were enumerated in the Exploring the Molecular Vision (EMV) conference of the ACS Society Committee on Chemical Education, and built scenarios that generally include data interpretation and query student knowledge in more than one of the traditional sub-disciplines. We ended up with 15 scenarios that support four exam items each for a total of 60 items on the exam. The Institute is also working from the EMV conference in our efforts to map the undergraduate content curriculum. The resulting map will be used to provide a form of criterion referencing of ACS Exams, in addition to the usual norm-referencing we have always done. Thus, the DUCK will be able to play a key role in programmatic assessment for departments who use ACS Exams."
ii. Grade Point Average (GPA)
    1. Overall Science/Mathematics GPA
    2. Laboratory Course GPA
iii. Performance on science portions of nationally-normed post-graduate examinations
iv. Student conference presentations and publications
v. Student employment, placement, and graduate school acceptance

D. Benchmark for the performance characteristics (see above table)

Typically the benchmark should be at 70% as in the BIPH and biology plans. However, because of the small number of chemistry majors in most courses, percentages cannot be easily used for one academic year. For example, there may only be 2 or 3 chemistry majors in some classes and yearly aggregate data would not be meaningful. Therefore, we will report raw data on an annual basis and aggregate data as percentages every 2 to 4 years.

- **External Reviewers' Comments/Concerns on each of the Review Criteria:**
- **Program Role and Mission and Consistency with University Mission:**
- **External and Internal Demand**
- **Program Quality**

- **Productivity, Costs, Efficiency**
- **Potential**
- **Additional Information**

In addition to commenting on each criterion, external reviewers are asked to fill in the grid below, providing a summative judgment on the overall success of the program on each criterion.

**Table 18. External Reviewer Feedback**

| Criterion | Yes | No |
|---|---|---|
| Does the program demonstrate significant alignment with campus Mission, Values, and Strategic Plans? | | |
| Does the program demonstrate substantial internal demand? | | |
| Does the program demonstrate substantial external demand? | | |
| Compared to other similar programs at similar institutions, is it of high quality? | | |
| Do program trends suggest potential for future program growth? | | |
| Did the additional information provided suggest that the program demonstrates significant contributions to the Campus, region? | | |

**IV. Deans' Recommendations Regarding the Future Status of the Program:**

- **Programs that are recommended for revision, merging or other action** will be charged to present specific plans for revision, etc. by December 1 following the recommendation of the deans. These plans must provide measurable objectives and a year by year plan for the delivery of these objectives. Failure to meet objectives may result in a decision to eliminate the program.
- **Programs that are recommended for additional investment** will be charged to present specific plans for revision, expansion, etc. by December 1 following the recommendation of the deans. These plans must how additional investment will positively affect the program in the categories of productivity and quality, and indicate how these enhancements will be measured over time both quantitatively and qualitatively.
- **Programs that are recommended for elimination** will be charged to present specific plans for phasing out the program, accommodating the graduation [of current students???]
- **Programs that are recommended for no change in status and** will not be required to make adjustments to their operations, nor will they be identified for the infusion of new resources.

**Program recommended for revision ____**

**Program recommended for additional investment ____**

**Program recommended for elimination ____**

**Program recommended for no change in status ____**

# External Review

# Bachelor of Arts in Chemistry

# Indiana University-Kokomo

Site visit: March 9-10, 2010

Report submitted: April 19, 2010

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Summary:

This reviewer visited the Indiana University Kokomo campus on March 10, 2010. The beautiful campus is home to a well-appointed science building with excellent facilities for teaching chemistry lectures, laboratories, and conducting undergraduate research. IUK chemistry faculty expressed the sentiment that the community may not perceive the excellence of the programs at the IUK campus, compared to those at the larger state universities. However, this reviewer felt that the IUK facilities are comparable to those of larger schools and the chemistry faculty members have strong research and teaching expertise.

Indiana University Kokomo is similar to the University of Indianapolis in that both schools attract students of largely average preparation, primarily from central Indiana, and both schools have excellent pre-health science programs with a strong liberal arts component. The chemistry core at IUK is similar to that of UIndy, but has a stronger analytical chemistry focus (as compared to the UIndy core which can be somewhat tailored toward a student's individual career objective, such as biochemistry). The schools differ significantly in the number of majors in the chemistry program.

The UIndy Chemistry Department successfully recruits science students to their major by active engagement with the freshman class, which creates demand for the program. The IUK chemistry major has little demand and the classrooms and laboratory space could easily accommodate more students. This may be a reflection of the IUK chemistry unit's culture. Specifically, there was some indication that IUK's chemistry faculty demonstrate a limited collegiality with one another. For example, curricular changes, laboratory management practices, policy implementations, community outreach, and other issues of general policy and implementation are not approached in a fully collaborative manner. During the site visit and from reading the program review, this reviewer noted little evidence of interdisciplinary collaboration from the tenured/tenure track IUK chemistry faculty. Additional efforts among the chemistry faculty at IUK to establish a team rapport and interdisciplinary connections could, in turn, provide the welcoming and nurturing environment that would attract chemistry majors.

The UIndy Chemistry Department's strong student-centered focus, which appeals to a large segment of the student population, was not mirrored at IUK—where the faculty have a more exclusive research focus and base much of their estimation of their own success on numbers of peer reviewed research publications. However, I believe that the chemistry program's external review process, the first since the chemistry major was instituted in 2003, was a good start in an effort of program quality assessment and improvement, since it provided a valuable opportunity for chemistry faculty to initiate reflection and communication with each other.

Summary table[†]:

| Criterion | Yes | No |
|---|---|---|
| Does the program demonstrate significant alignment with campus Mission, Values, and Strategic Plans? | X | |
| Does the program demonstrate substantial internal demand? | | X |
| Does the program demonstrate substantial external demand? | | X |
| Compared to other similar programs at similar institutions, is it of high quality? | X | |
| Does the program demonstrate significant overall productivity? | | X |
| Do program trends suggest potential for future program growth? | | X* |
| Did the additional information provided suggest that the program demonstrates significant contributions to the campus, region? | X** | |

[†]Each of these sections is elaborated in the subsequent pages. My foremost recommendation is that the program be given a finite deadline (for example, two years) to demonstrate a significant increase in enrollment.

*Some suggestions for improved recruitment and retention are found in the last section of the report entitled "Additional Information".

**I believe that a chemistry major is a valuable addition to any university's curriculum. Several of the IUK NIMS faculty members have excellent ideas for community outreach and connections with local industry. More widespread implementation of these ideas could improve the community's perception of the university, and could attract applicants to make the chemistry program a thriving and valuable part of the university and region.

III. External Reviewer's Comments/Concerns on each of the Review Criteria:

**•Program Role and Mission and Consistency with University Mission**

The chemistry major at Indiana University Kokomo is aligned with the university's mission and strategic plan. As stated in the program review, the chemistry major provides opportunities both for students seeking to enter careers in chemistry, and for students applying for entrance to post-graduate degree programs in both technical areas and in health sciences. Moreover, the program provides a strong preparation for those pursuing degrees in secondary chemistry teaching. A mission of the university is to provide a strong regional choice for education for students living within commuting distance of campus. The chemistry major's emphasis on hands-on, lab-based science is an excellent preparation for the types of technical jobs available in the Howard County region. The program would also lend itself well to those career changers who have left/lost technical jobs and are seeking training and employment in new and more economically robust disciplines. The program also prepares students well for admission to graduate/professional schools in a variety of areas.

**•External and Internal Demand**

There is excellent and increasing demand for the 100-level service/non-major courses in chemistry. The growing demand for these courses could reflect an increase in the numbers of biology and pre-health science majors—students who could, ultimately, take an interest in chemistry and choose to major in it. However, enrollment in the 100-level courses is a different issue than the demand for the chemistry major itself, which requires students to be enrolled in the upper-level courses for there to be considered significant demand.

The chemistry laboratories are well-equipped, modern facilities, with a high level of instrumentation, space, and supplies. These laboratories could easily accommodate more students than are currently enrolled in the upper-level chemistry classes. This brings to forefront the overarching problem of the IUK chemistry major—the lack of demand. The most disconcerting trend is the decrease in the number of majors since the inception of the program. This is caused both by low admissions numbers and low retention numbers.

The low numbers of admitted chemistry majors is caused, in part, by a lack of visibility of the chemistry program in the local region. Prospective students are both unaware of the major and unaware of the myriad of job opportunities available to BA chemists. They also don't recognize the chemistry program as the strong preparation for professional schools that it is, since there is a prevailing culture at IUK that biology is the most appropriate major for pre-professional students.

There has been significant effort to increase the visibility of the chemistry major in the region by hosting summer camps for kids, workshops for secondary teachers, science fairs, etc. by some members of the department. These efforts should be supported and continued. In addition, demand for the major could be increased by further developing regional internship opportunities, which is an ongoing effort of NIMS. However, I believe that much of this work is being done by individuals that are not among the principal faculty of the chemistry unit. The tenured and tenure-track chemistry faculty need to take a stronger role in marketing the major, increasing its

visibility in the geographic region, establishing opportunities for the students, and nurturing existing students.

There seems to be a difference in philosophy about outreach and student engagement among the department members. Most of the community outreach seems to come from faculty who are not tenured chemistry faculty. I received a strong impression during my visit that these are the faculty members that are most responsive to student needs. These faculty, however, should technically be the least invested in the success of the program. In particular, I would encourage Dr. Kasem to take a stronger leadership role in determining the future of the chemistry program, and urge him to dedicate more of his time and effort to recruitment and retention. This can be accomplished through summer activities, active outreach to the median students in chemistry classes, and regional involvement in service activities.

In addition to enhanced recruitment activities, as well as elucidation of employment opportunities for students and personal contact with students to help improve retention, another way to increase the number of majors would be to collaborate with other, more populated majors. For example, changing the School of Education's chemistry teaching major to a more content-based major (a change which I believe has been proposed at the state level) may allow IUK to adjust the curriculum for the chemistry teaching major so that these students may be able to be counted both as School of Education students and as chemistry majors. Also, a biological chemistry track (as has been suggested) could be established to draw from the strengths of both majors to provide the optimal preparation for students entering pre-professional programs such as pre-medical and pre-pharmacy. Minor changes such as these are expected to have a significant positive impact the number of majors in chemistry.

**•Program Quality**

The IUK chemistry program is home to highly capable and technically expert faculty. The chemistry faculty members have outstanding credentials and expertise in their field. For example, Dr. Kasem's impressive list of publications would be worthy of a faculty member teaching at a much larger institution with a stronger research focus. The faculty members are typically involved as reviewers and editors of technical journals. Others have a strong service-based focus, which is equally, if not more, important to the future health of the chemistry program. Several courses are assessed using the American Chemical Society standardized exams, which are the accepted standard and nationally normed. The chemistry faculty members are also considering instituting an exit exam for all senior majors, which would further validate the quality of the program. Finally, the laboratory and classroom space and level of equipment parallels that found at much larger schools.

**•Productivity, Costs, Efficiency**

A faculty of four seems sizable for the few majors in this program. However, the lower-level service courses are quite full and one professor is also involved with teaching in other program areas, such as Freshmen Learning Communities. The lower-level courses are an efficient use of faculty time. Of greater concern are the upper-level courses. Traditionally a chemistry (or any lab-based science) program is one of the more expensive programs to operate on any campus.

This is due to additional budgetary requirements such as equipment purchase and maintenance, supplies (glassware and reagents), and disposal budget lines. The low enrollment in the upper-level courses would make these classes quite costly and inefficient to run.

At UIndy, we are required to cancel a class with fewer than six or eight students enrolled, or teach the class for reduced faculty compensation. I am not certain whether this is a standard policy at IUK. However, from the teaching loads provided in the program review, I believe that underenrolled courses are not canceled in the chemistry program, since the few majors in the program need these courses to graduate. This light teaching load on the part of the chemistry faculty (specifically for those teaching the low numbers of students in the upper level courses) has allowed them to devote greater time to research, at which they have been quite productive. Still, the research projects have not successfully attracted large amounts of external grant money to the university, so these programs are also somewhat costly to run. However, the prestige brought to the university by publications and presentations of the research results may make this an investment worth the budgetary cost.

**•Potential**

Generally speaking, I believe that the chemistry major is one of the most valuable majors at a small, liberal arts university. It is often the major in which bachelor degree holders earn the highest starting salary and obtain jobs with the most potential for advancement. The problem-solving skills learned in this challenging, math-based major lend themselves well to both future discovery research as well as management opportunities. For example, I have had Lilly executives tell me that they would rather teach "business skills" to a chemist than "chemistry skills" to a business graduate. Moreover, it is a strong major for any pre-professional program in the health sciences, such as medical, dental, pharmacy, or physical therapy, and majoring in chemistry should give professional school candidates an edge in the admissions process.

For these reasons, I believe that every effort should be made to preserve the chemistry major at IUK. Despite the apparent internal difficulties and lack of cohesive vision and clear leadership among members of the unit, if the number of majors could be grown to the amount dictated by the Interim Chancellor, this major would be a strong addition to the IUK campus and align well with the university mission and strategic plan. Thus I believe that the chemistry unit members should collaborate to develop an action plan, implementable this upcoming school year, to increase both enrollment and retention in the chemistry program.

**•Additional Information**

*Safety*: I did not approach this site visit with the plan to consider safety concerns. However, I noted a few issues that are easily remediable. First, the hood sashes were raised to a half-open height in empty laboratory rooms. For safety considerations and cost reduction, I would recommend that the hood sashes be kept closed at all times when the hoods are not in use. I also noted an employee wheeling a cart full of chemicals with no safety glasses; likewise I was not offered safety glasses during my tour of the laboratory facilities. As faculty, we need to demonstrate appropriate safety consciousness and use of personal protective equipment to our students so they learn good safety habits in turn.

*Collegiality*: The overriding sentiment of the several administrators that I spoke with was that the collaborative spirit necessary to develop the chemistry major was not present among the chemistry faculty. It should be noted, though, that the chemistry faculty members, when interviewed individually, did not state the same concerns. The administration felt, however, that the disposition of a specific chemistry faculty member could be detrimental to the health of the program. It was stated that this faculty member, a leader in the department, sometimes appeared to possess an air of superiority and had been known to belittle colleagues and students. However, this may not be an issue impacting collegiality within NIMS, but affecting, instead, more widespread university service with faculty from other disciplines. The administration indicated that they would be willing to invest in faculty development and mentoring for this individual to support modification of these perceptions and to overcome these challenges.

*Demand:* I will also address the primary concern of the Interim Chancellor, Dr. Stuart Green, in this section. Essentially, the number of majors will need to be substantially increased, to a level of 15 per year, or the program is in jeopardy of being suspended. I would recommend that the chemistry program be given a limited additional amount of time (for example, two years) to show successful progress in recruitment of new students and retention of existing majors. I recommend that within two years sufficient progress toward the goal would be reflected by a total of 10 designated majors or recent graduates at the end of the 2012 spring semester.

The unit members will need to collaboratively work together to plan and implement some significant new policies in order to be successful at these goals. The planning stage should run through early summer with some support provided for this work, and should include the development of clear action items. Significant changes in recruitment and retention policies should be implemented for the incoming class in the fall of 2010.

The IUK chemistry major has existed since 2003. These past six years should have been adequate time to establish a solid body of majors and chemistry degree recipients. However, to this date, only nine IUK graduates hold a BA in chemistry, and numbers of degree candidates seem to be on a downward, rather than upward, trend. However, two chemistry majors will graduate this May, to give a total of 11 chemistry degree recipients. Still, this program seems to be notably inefficient in terms of tuition dollars earned per program graduate, and I understand the administration's desire to suspend the program.

Immediate and drastic measures must be taken to increase the number of majors to help this program become self-sustainable so that it does not become eliminated during this time of poor regional economy and drastic state budget cuts. One significant drawback to the quick implementation of changes seems to be a lack of clear leadership among the chemistry unit members to take on a project of this scope. One chemistry professor demonstrates a priority toward a personal research agenda rather than in service to the department or university. Another professor is pre-tenured and, as such, needs to devote considerable time and energy to developing and teaching courses and achieving tenure. A third professor has demonstrated the most interest in and ability for leadership and service work of this nature, demonstrated by writing the program review report and having the most active hand in campus and community outreach of all of the chemistry faculty members. However, this professor is not tenured and is near retirement, so has the least to gain by retaining the major in chemistry. The final chemistry

unit member holds a masters degree, and has a lighter teaching load to allow time for laboratory preparation and to serve as the unit's chemical hygiene officer.

**Primary Goal—to increase the number of Chemistry Majors at IU-Kokomo by recruitment of new students and retention of existing students**

The goal of the IU-Kokomo Department of Natural, Information, and Mathematical Sciences (NIMS) is to increase its number of chemistry majors to 15 per year, which is an attainable number with a few changes in philosophy of the chemistry faculty and some time spent on active recruitment and retention on the part of the faculty. The ideas laid out here will make extra work for the already busy Chemistry faculty. However, this is necessary work to prevent the major from being suspended, which would result in the loss of the upper-level chemistry courses. Removing these courses from the IUK catalog would sentence tenured chemistry faculty to exclusively teaching lower-level chemistry courses as service courses to non-majors only. Loss of the major would also mean a reduction in students interested in undergraduate research which would be an unfortunate waste of the extensive instrumentation and considerable expertise of the chemistry faculty.

There is the need for someone to take leadership and ownership of the recruitment process for it to be ultimately successful. This leadership role should fall to a *chemistry* unit member, not to a non-chemistry faculty member in the interdisciplinary Department of NIMS. Thus I believe that the leadership for these changes should come from Dr. Kasem Kasem, as the only tenured member of the chemistry faculty. The chemistry unit should behave as a team to determine the action measures and policy changes that will be implemented in the effort to populate the major.

**Recruitment:**

Chemistry majors can either be recruited from prospective high school students/community members that are career changers OR recruited to the chemistry major after they are already enrolled at IU-Kokomo as degree candidates in other disciplines.

There are two types students that will seek a degree in chemistry, and both types need to be recruited with equal vigor. They are:

A. Chemistry majors that want to work as bench/research chemists after graduation (either with a BA or an advanced degree in chemistry or a related field such as biochemistry, forensic science, or informatics).

B. Students that do not plan to ultimately work as chemists. This category of student could include pre-professional (pre-med, pre-dent, pre-pharm, etc.) students or pre-service teachers.

Both types of students are equally valuable as chemistry majors. Both types of students should be recruited with equal enthusiasm. There seems to be a chemistry unit bias that the "true" chemistry majors are superior to those that are merely seeking a degree in chemistry as a route to some other profession. A chemistry major does not need to have a research-based degree to be included in your count of majors to retain your funding and advanced-level chemistry curriculum.

**Ideas for recruitment of prospective high school students:**

*Regular meetings with Office of Admissions staff:*
Strengthen your relationship with the Office of Admissions. It is apparently not well known by admissions officers at IU-Kokomo that chemistry is a viable major for pre-med (and other pre-professional—ex. pre-dent, pre-pharm) students. Institute regular meetings (at least annual, in the fall, while admissions is gearing up for the new incoming class) with the Office of Admissions to encourage admissions staff to recruit prospective students for the chemistry major. Make sure that you have a presence on the admissions material that is sent to prospective students, published to the admissions website, and displayed on posters at college fairs.

*Work with the Office of Communication and Marketing on the Chemistry brochure:*
Dr. Chauret is working with the Office of Communication and Marketing to have the Chemistry brochure professionally printed. I did not see the current brochure, but make sure the professionally printed brochure highlights strengths of the chemistry laboratories and courses, provides biographies of chemistry faculty members, lists careers for which a chemistry major is optimal preparation (including health care-related careers), and gives information on monetary scholarship opportunities for chemistry or related majors.

*Individual meetings with prospective students on formal campus visits:*
I would suggest that the Office of Admissions makes frequent use of chemistry faculty and staff when students and their families arrive for campus visits. At UIndy, all Chemistry Department members are involved with campus visits by meeting regularly with multiple prospective students throughout the active campus visit season. In many cases, that personal connection with a member of the department enhances accessibility and ultimately permits direct recruitment.

*Showcase your major, your courses, and your laboratories during campus visits:*
Encourage prospective students to attend chemistry lectures and shadow chemistry majors. Offer tours of the research and teaching laboratories to highlight your instrumentation and excellent facilities. Sell yourself as an applied major that will prepare a student – by hands-on and problem solving skills – for a whole host of careers.

*Organized large group meetings with prospective students:*
Make sure chemistry has a presence at any weekend open house activity. This could include a "Future Health Professions Day" (a very successful recruitment day for UIndy in February), scholarship competitions, and other campus open houses. We perform "chemistry magic" shows at our annual (March) Campus Camp-In and at "Welcome Week" (August) programs.

*Scholarships specifically for chemistry majors:*
Offer small 4-year scholarships to help recruit prospective majors. Do not tie your scholarship offers to those students that want to be "research chemists", only to those students seeking to major in chemistry. Some of any university's most generous and affluent alumni are doctors and dentists. Building a body of alumni with chemistry degrees will ultimately provide donations to help sustain a scholarship program in the long term.

*Community Outreach*
Continue your excellent level of involvement in regional science fairs. Other ideas include developing a partnership with a local school in which chemistry faculty members mentor

middle/high school student science fair projects. Teaching content-based summer teacher workshops for possible continuing education credits will also help your name recognition and reputation among teachers at local schools. I would also recommend becoming involved with the Indiana Section American Chemical Society activities—ACS has substantial funds and will pay for keynote speakers, refreshments, etc. which will allow you to host educational outreach events at no cost to the university as long as you can commit the time to organize the activity. For example, through ACS, we hosted a successful "Career Night in Forensic Science" at UIndy that drew 200+ high school students to our campus. Please note that we have learned not to spend time and resources on outreach events that target the top-ranked high school students—these students will probably not become serious candidates for university admission. Your target student, like ours, is largely the student of average preparation in your local area. Focus your recruitment efforts on programs that will attract this middle group of prospective students.

*Creating new "exciting" majors and concentrations/niche areas within the chemistry program:*
I heard some discussion during my visit about adapting the chemistry program as a preparatory curriculum for other programs such as the IUPUI program in Forensic Sciences, or instituting a biological chemistry track for students with interest in professional schools or biotechnology careers. Indeed, it is a good selling point for a program to have "niche" areas of specialization such as these. Other niche programs could include Medical Technology, Environmental Sciences (linked to the geology program at IUK), Chemistry Teaching, recruiting AS chemists with 2-year Ivy Tech degrees to the 4-year BA degree, developing an applied instrumental-based chemistry major through co-op programs at local industries, etc. The city of Kokomo has a culture of applications-based, hands-on industry, which should lend itself well to establishing a program in an applied field such as industrial chemistry. I applaud Dr. Chauret's success in establishing internship programs at local industries. This is much needed work to ensure the industrial training and employability of IUK graduates, and for networking with the local technical community.

However, I would suggest that you get the chemistry degree program on more solid footing before investing a lot of time and energy into developing new majors and curricula. Then complete the appropriate research to determine which niche market would be most lucrative. Many schools already have their niche markets established and I don't believe it would be financially beneficial to overlap with a successful existing program. The one exception that may be worth implementing now would be the biological chemistry concentration, which is already being discussed. This is similar to the UIndy major that is a huge draw for our pre-professional students. It would give students a local option for preparation for the Indianapolis-based professional programs in medicine, dentistry, physical therapy, etc.

**Ideas for recruitment of existing IU-Kokomo students in other degree programs:**

*Meeting with professional advisors:*
Some marketing efforts by the chemistry faculty members will be needed to help promote the chemistry major internally. I would recommend meeting with professional advisors so that they are aware of the strengths of the chemistry major. According to the scatter sheet for the Bachelor of Arts in Chemistry, the chemistry major has enough flexibility that a student can double major in Biology and Chemistry with only a few additional courses. IU-Kokomo students need to be made aware of the significant advantages of a degree in chemistry, especially if combined with a degree in a related area such as biology or math.

•success in the challenging chemistry major gives a favorable impression on admissions applications for professional schools

•there are well-paid technical jobs available in the local area for bench chemists

•a chemistry major does not have to do bench chemistry—but is also eligible for jobs in sales and marketing for a technical company

•a chemistry major is a suitable preparation for an advanced degree in chemistry or in related areas such as biochemistry, forensic science, nutrition, informatics, environmental sciences, etc.

•a chemistry major is a good preparation for advanced degrees that are not directly related to chemistry—i.e. for students that want to continue in graduate school for an MBA, law degree, library science degree, etc.

•the shortage of secondary teachers in STEM areas makes teaching jobs plentiful—this also attracts students with an interest in coaching athletics or other activities

*The chemistry minor:*
Continue to advertise your minor heavily. Include minors in recruitment, NIMS science club, and chemistry unit social activities. Since a biology major can earn a chemistry minor with one additional course, this should be a popular option.

*Pre-medical (and other pre-professional) advising:*
Become contributing secondary advisors (along with the professional advisors) for pre-medical (and other pre-professional) students. One of our departmental members is the pre-med (and pre-professional) advisor, so students of all majors meet with this faculty member. This helps the pre-med students' comfort level with our department. This faculty member also attends the annual meeting at IU School of Medicine for pre-med advisors, and is the source of all pre-med information for our pre-med students. He provides advice on preparation for the MCAT and other professional school admissions tests and also organizes a practice MCAT session.

*Recruitment from the C105 course:*
Many UIndy students arrive at campus as biology majors because they had the greatest exposure to biology during their high school years. These are often talented students with strong math skills that had never considered chemistry as a viable major for their career aspirations. At UIndy, through our gentle encouragement in our first-year majors course, we gain a lot of double majors. This could be your easiest and most cost/time-effective recruitment method. Although the chemistry unit members at IUK believe that they are already doing this successfully, I would respectfully suggest some changes in approach. The professors stated that they recruit from this class by presenting research opportunities to the students, and suggesting that these students undertake research projects with the faculty members. These research opportunities in pure chemistry would likely be of little or no interest to a prospective pre-med or other pre-health science student, and I suspect that this is not a method that will give a high rate of success for increasing numbers of majors. I believe that the typical underclassman student could be intimidated (or at best, disinterested) by an offer of conducting research to the level that would

be accepted as a publication in a peer-reviewed journal. Students at IU-Kokomo are likely not as academically elite as those that would be found at IUB or Purdue, and IUK students likely have a different background, preparation, and aspirations. Publicizing your success in research and publications to the underclassmen students could come across as elitist and exclusionary and actually deter prospective majors, especially those that could already have (possibly unwarranted) low confidence in their abilities. Building a student's self-confidence in chemistry through encouragement, mutual respect, and providing a fun and nurturing environment would be a better way to attract them to the major. I am a firm believer that simple personal contact and encouragement (by individually talking to and e-mailing successful students) will draw students to a professor. You need to establish some positive lines of communication with students by praising those that do well on tests and inviting them to be chemistry majors—without promoting the research aspect until a student has the interest, maturity, and suitable career orientation so that research would benefit his or her future.

*Provide fun opportunities for Chemistry majors:*
Establish some perquisites for chemistry majors such as social outings, club meetings, volunteer opportunities, etc. Students love to have personal interactions with professors. These opportunities could include field trips, attendance at local ACS meetings, or cookouts/socials at faculty members' houses. Deepen the involvement of the chemistry faculty in the NIMS science club. IUK has the challenging environment for obtaining good attendance at social activities due to a non-resident student population. However, I have been successful in recruiting students to help judge at science fairs, assist with in-house demos for visitors, etc. by offering extra credit, and this method may also be successful at IUK.

**Retention of existing chemistry majors:**

*Advising:*
Many retention problems arise because of a student's inadequate preparation at the high school level, and many prospective chemistry majors will not be successful in this major if they are not properly advised to take the appropriate level courses upon entrance to program. Many find that the program is more academically challenging than they expected, and they are not prepared for the amount of work it will take for success in the courses. Review your prerequisites for the C105 course, and then make sure that these prerequisites are of the appropriate rigor and enforced. This will require the assistance of the professional advisors, and I urge you to meet with them on a regular basis and communicate with them frequently. This may also require a personal look at the class roster, by the professor, before classes begin to determine that each student has met the required math/science prerequisites, if the computer system is not coded to find these errors. At UIndy, the chemistry faculty serve as primary advisors for chemistry majors; I understand that this is no longer the case at IUK. However, I urge you to get a list of your chemistry majors and (possibly) pre-med/pre-professional majors and keep in touch by them by e-mail to ensure that they don't have questions about the curriculum. At UIndy, we are also heavily involved in summer advising, and chemistry department members meet with most of the pre-professional students with undeclared majors, providing a positive personal interaction which often draws these students to the chemistry major.

*Math Skills:*
Many students are unsuccessful in chemistry due to a poor preparation in math. Again, police the prerequisites (or increase the math requirements) to make sure all enrolled students in C105

have adequate math skills to be successful in the course. At UIndy, we give a 20-point basic math assessment on the second day of class and advise students receiving less than 10/20 to take the lower level chemistry class (C101) and/or pre-calc before starting C105. We strongly recommend tutoring by suggesting (almost daily) that the students visit the math and chemistry tutors available to them free of charge (the department pays the tutors as laboratory assistants).

*Drop/Add Policy:*
Although, at UIndy, it is general university policy to allow drop/adds only in the first week of classes, we allow late drop/adds within the Chemistry Department and in the Math Department by a special arrangement with the Registrar's Office. We will allow a drop/add after the official deadline, as long as the student is moving to a lower level class. I understand that this policy also exists at IUK for the math classes, and I would suggest adding this for chemistry as well. This is most facile when the lower level section of chemistry is scheduled at the same time as the Principles of Chemistry course. If a student has a poor grade after about 4 weeks in C105, I would suggest allowing the student to transfer to a more introductory chemistry course. This policy has been successful for many students at UIndy who would have otherwise needed to drop a 4-credit hour course–with the resulting financial aid and insurance eligibility complications of becoming a part time student.

**Conclusion:**

The IUK chemistry major could become a thriving and valuable part of the IUK campus with some changes in unit culture and policies. Please contact me at *kstickney@uindy.edu* if you would like further clarification of the ideas and comments I've presented here.

**Response to the External Review of the Chemistry B.A. (IU Kokomo, May 2010)**

The chemistry faculty members appreciate the review conducted by Dr. Katherine Stickney of the University of Indianapolis. We anticipated many of her comments, and our responses to her major points appear below.

**I. Increasing demand for the major: Goal: 10 majors by Spring 2012; 15 graduates in 5 years.**

**A. Regarding recruitment/enrollment of incoming chemistry majors, we will**

- market the chemistry major as a degree with many applications
- need brochures/videos/website content and institutional support for those materials
- collaborate with Admissions events, on and off campus. Regular meetings will Reeta will be planned.
- survey local industries to identify jobs filled by chemists
- continue to collaborate with the School of Education regarding their licensure in science (including chemistry)
- work towards obtaining dedicated scholarships (e.g. NSF Grant)
- post chemistry-related material (data about jobs nationally-locally, career perspective, etc.) on both the NIMS website and the NIMS Facebook page.

**B. Regarding recruitment of current students, we will**

- collaborate with professional advisors to emphasize the benefits of the chemistry major for premeds, etc.
- describe the value of the chemistry major to CHEM-C 105/C 106 students around mid-term.
- invite professionals (chemists) from Haynes/Delphi/Syndicates Sales to come to talk to students on an annual basis about careers in chemistry. This could be done through the NIMS Pre-professional club.

**II. Increasing retention**

**A. In lower level classes, we will**

- work with advisors to ensure that students in CHEM-C 105 are at least taking MATH-M 125 concurrently
- work with the registrar and the bursar to facilitate the transfer of students (without penalty) to CHEM-C 101 for "remedial work" (in the Spring semester) if they do poorly on the first CHEM-C 105 exam (in the Fall semester)
- assign a dedicated tutor for CHEM-C 105/C 106 (pending funding) and add a one-hour required recitation after each lab period. The recitations will be assigned to the tutor and will be devoted to working on problems and lab reports.
- develop the curriculum of a dedicated FLC for NIMS students

**B. Of majors, we will**

- establish more social/service opportunities – (for example, through the NIMS club)

- collaborate with local businesses to increase number of internships

**III. Degree requirements/tracks**

**A. Modifying major requirements for specific tracks. We will**

- add a chemical biology track as proposed in the self-review report
- create an environmental chemistry and energy track within the chemistry B.A. (with Geology and Ecology courses)
- Promote double majors (chemistry and biology) for high achieving students

**B. Marketing the chemistry minor. We will**

- work with all professional advisors to market the chemistry minor

**IV. Collaborating within the department. We will**

- work as a team on recruitment issues and assign specific tasks to each chemistry member