**DIVISION OF NATURAL SCIENCES AND MATHEMATICS**
**2009-2010 ANNUAL DEPARTMENTAL REPORT**

## I. EXECUTIVE SUMMARY

The chemistry department graduated four students during the 2009-2010 academic year with three students earning the traditional chemistry degree and one completing the requirements of the forensic chemistry option.

The demand for the Ch 104-106 sequence driven by increasing numbers of students entering the pre-nursing program continued. To aid accessibility of this course, the department instituted a trailer course offering one section beginning with Ch 104 in the winter term (Ch 105 spring; Ch 106 summer) so that students would not have to delay by a full year completing the sequence if they were unable to enroll in the regular fall offering of Ch 104 due to lack of seats or lack of course prerequisites. The growth in this area necessitated the addition of one additional adjunct at approximately 1 FTE for the entire academic year. In addition, enrollments remains remained strong for the summer session offering of the entire sequence. The growth in this area s expected to continue for the 2010-2011 academic year as evidenced by the addition of one 24 student laboratory section above the levels for fall 2009.

Enrollments in other areas remain strong including the upper division courses. Although most programs in the Biology Department no longer require organic chemistry, enrollments have held relatively constant due to increases in second year chemistry majors and students pursuing chemistry minors.

WOU chemistry graduates remain competitive in gaining entrance to graduate programs. We currently have four graduates in PhD programs, and 2009-2010 graduate Jennifer Blaser has been accepted into the graduate chemistry program at Colorado State University for fall 2010.

The addition of laboratory computers and smart room capability into NS 115 during the year has given us the ability to begin better integrate technology into the nursing chemistry, organic chemistry and applications in forensic chemistry laboratory classes. We look forward to making many changes in the curriculum of those laboratory experiences utilizing this equipment.

## II. ENROLLMENT TRENDS

The Chemistry Department continues to experience growth in the Ch 104-106 sequence fueled by the growth in students pursuing the pre-nursing curriculum. To accommodate the students needing this sequence, a trailer section consisting of one lecture and one laboratory section. The trailer section runs began in the winter term and was scheduled to run winter/spring/fall 2010. The growth for this course has continued to increase as evidenced in the preregistration figures for Fall 2010. Growth between Fall 2009 and 2010 required the addition of an additional 24 lecture/lab seats. The increased enrollment required the hiring of an additional adjunct whose responsibilities lie almost exclusively in the Ch 100 course. Comparison of enrollments for Fall 2007 with pre-enrollment data for Fall 2010 shows the rapid growth over the time period:

| | Ch 104 | Ch 106 | Total Ch 100 sequence Fall term |
|---|---|---|---|
| Fall 2007 | 132 | N/A | 132 |
| Fall 2010 | 257 | 8 | 265 |

In the 2007-2010 time period, the Chemistry 100 sequence has doubled in student enrollment and increased from two lecture sections to three large lecture sections and one small trailer section. In addition to the traditional school year increases, there has been a strong enrollment in the sequence during the summer term:

| | |
|---|---|
| Ch 104 | 14 |
| Ch 105 | 21 |
| Ch 106 | 13 |
| Total Ch 100 sequence Summer 2010 | 48 |

The increased enrollment required the hiring of an additional adjunct whose responsibilities lie almost exclusively in the Ch 100 course. of the growth of the Chemistry 100 sequence can be of 1 FTE of additional adjunct course for 2008-2009 which necessitated the addition of lecture seats and two laboratory sections.

Enrollments in the Ch 221-223 sequence remain strong. The one enrollment trend in this sequence is a smaller enrollment in the Ch 221 course during the fall term with larger enrollments in the trailer sections which begins in the winter. This change is due to enforcement of course prerequisites which is requiring more students to complete fulfill the prerequisites during the fall term.

| | Ch 221 | Ch 223 | Total Ch 200 sequence Fall term |
|---|---|---|---|
| Fall 2007 | 80 | 14 | 94 |
| Fall 2010 | 58 | 48 | 106 |

Upper division enrollments show increases or steady enrollments. Ch 334-336 remains steady compared to 2007 even though this course is no longer required in any Biology programs other than the various pre-professional (medical fields) programs. Enrollments remain steady in the other required upper division courses without any notable changes.

## III. SUMMARY OF PROGRAM CURRICULUM CHANGES

- Ch 334, 335, 336 changed from 4 credit hours with embedded laboratory to 3 credit hours no lab (approved in catalog)
- Ch 337 Organic Chemistry Lab I added 1 credit hour one lab meeting per week winter term (approved in catalog)
- Ch 338 Organic Chemistry Lab II added 2 credit hours two lab meetings per week spring term (approved in catalog)
- Ch 345 Introduction to Toxicology 3 credit hours (approved but not in catalog; scheduled for Spring 2011)

The above changes align with programs at other institutions. Moving the first lab to winter term allows students to have some familiarity with organic chemistry to better understand laboratory concepts.

- Added trailer sections of Ch 104, 105, 106 Introductory Chemistry

  Provides additional access to accommodate the rising enrollment in the pre-nursing program

## IV. PROGRAM ASSESSMENT ACTIVITIES AND RESULTS

The Chemistry Department utilizes both formative and summative methods of assessment to determine how well the program meets our student outcome goals.

Formative Assessment

- Traditional methods including quizzes and exams taking the form of essays, multiple choice, true/false, and problem solving
- In class assessment using clicker technology
- Individual and group oral presentations
  - poster presentations
  - powerpoint presentations
- Significant writing component including
  - laboratory notebooks
  - formal laboratory reports
  - annotated bibliographies
  - abstracts
  - web page development
- Critical thinking skills are tested via the solving of laboratory unknowns and the development of research questions

The style and level of formative assessment varies with the type of course content and the instructor.

Formative Assessment highlights:

- The use of clickers in lecture particularly in the Ch 104-106 sequence gave immediate feedback of the level of understanding of topic being discussed. This allowed the instructor to adjust the lecture and increase student learning
- The Ch 334-336 sequence was assessed through the administration of the American Chemical Society standardized organic chemistry examination and the results compared to national norms. Within the OUS system, performances at the $50^{th}$ percentile or above are considered to show successful mastery of organic chemistry at the upper division level. The results for the Ch 336 students in Spring 2010 showed that half the students in the class scored at or above this level and 33% of the class scored above the $65^{th}$ percentile and two students scored above the $90^{th}$ percentile (93 and 96 percentile).
- Use of embedded GRE and MCAT questions within the CH 450/451 exam material to gauge the proficiency of these students in the area of biochemistry for entry into professional and graduate school.

Summative Assessment

Summative assessment is accomplished in via capstone courses and an exit exam. Students take two capstone offerings Ch 461/462 (a two term, inquiry-based laboratory course) and Ch 407 (presentation of a literature or research seminar). Ch 461/462 is offered alternate years and not offered in 2009-2010.

- Senior seminars are presented during the Academic Excellence Showcase and evaluated by a panel of judges. The panel of judges was identical for the last two years allowing direct comparison of the seminar ratings.The compilation of judging panel scores showed this year's seminars to be among the best ever presented both in the quality of the organization, oral presentation and in the area of depth of knowledge of the topic. The mean overall score was 189/200 (range 173 – 198) compared to a mean of 171/200 (range 130-192) for 2008-2009.
- The ETS Field Test for Chemistry has been administered to graduating students for the last three years.
    - The exam was administered during finals week to three graduating seniors (one Dec. 2009 graduation took the exam in June 2009) and one student graduating during winter quarter 2011. The exam results are not yet available.
    - The National norms for the 2008-2009 exam were received during 2009-2010. The mean score for all WOU students was 151 with a standard deviation =8 (total exam score range 120-200 pts). This translates to a mean institutional percentile of 60% which was very close to the results from 2008-2009 (mean score 152).
- The ETS Field Test for Chemistry is not a perfect fit assessing the WOU chemistry graduates due to the coursework differences between the two options available within the department that are necessary to provide appropriate career preparation.
- In 2010-2011, we will be switching to the American Chemical Society exit examination assessing the skills expected of an ACS certified chemist and appears to be a better tool for assessing critical thinking skills. This test requires students to apply chemical concepts from several core chemistry areas in conjunction to a given scenarios rather than the type of objective questions found in the ETS test. The test will be in its third year of national use next year.

## V. SWOT ANALYSIS

**a. Strengths** *(Key words: capabilities, resources, assets, marketing, innovative aspects, value, quality)*

- The Chemistry Department is composed of three tenured, one tenure-track, two fulltime adjuncts and two specialty adjuncts from the Oregon State Police crime laboratory. This faculty is capable and versatile with each member able to teach in more than one area within the program and is the department's most valuable resource.
- A strength of the department is the commitment of the faculty to integrate innovative activities and projects into the curriculum.
    - Students work on research projects as part of laboratory coursework
    - Innovative use of technology

        - Project-based content learning through video production, web authoring, computer application design, etc
        - Use of clicker methodology to assess student learning during lecture
        - Hands on use of laboratory instrumentation including the opportunity to set up and learn how to operate instruments from manuals, etc
    - WOU possesses the only program within the OUS system that is specifically designed to train students in the area of Forensic Chemistry and that involves OSP professionals to teach the techniques currently used in the working forensic lab.
    - WOU chemistry graduates compete favorably for employment in the region
    - WOU chemistry graduates do well in graduate programs. We currently have four graduates performing well in their pursuit of PhD degrees at Oregon State University, the University of Utah, Oklahoma State University and the John Jay College of Criminal Justice (the foremost graduate program in forensics in the U.S.)

**b. Opportunities** *(Key words: market developments, industry trends, nice markets, innovation, partnerships)*

- We have the opportunity to attract students in pre-nursing by packaging current forensic course offerings as well as a new course offering in toxicology/pharmacology into a 12 hr upper division block that could be used in the nursing program (or the forensic chemistry major). Forensic nursing is a rapidly developing area in the health care industry.
- Now that the department possesses a faculty member whose specialty is biochemistry, we can upgrade our offerings in this area to prepare students for graduate work in areas such as toxicology and pharmacology.
- Continue our interaction with the OSP crime lab by integrating lab experts in our curriculum and maintaining student practica positions within the laboratory. After working with OSP professionals, our students fare well in acquiring forensic employment within the system in an area that has a limited employment market

**c. Challenges** *(Key words: market demand, sustainability, obstacles, weaknesses)*

- Finite resources for maintenance of the Department's instrument holdings and upgrading of instruments to state-of-the-art models and acquisition of expensive forensic instrumentation and basic chemical instrumentation such as a nuclear magnetic resonance spectrometer. Such instrumentation frequently costs in excess of $100,000 for the initial purchase and brings with it ongoing operational costs.
- There is a limited market demand for forensic specialists. This challenge is met within the curriculum by providing students in the forensic major with the skills needed to be marketable as chemists.

- To accommodate the continuing growth of the Ch 100 sequence to meet the demand of the pre-nursing program without sacrificing in other programmatic options.
- We identified one weakness in the area of Quality Assurance/Quality Control within our curriculum. This is an area which would make our students more desirable to potential employers.

**d. Vulnerabilities (***Key words: gaps in capabilities, financials, cash flow, supply chain, disadvantages*

- Having to rely on adjunct personnel in meet the demands of pre-nursing program. This reliance places us in jeopardy due to the volatile nature of such teaching positions. For example, we lost one excellent adjunct instructor when a more lucrative industrial position became available during the 2009-2010 academic year.
- Added pressures to maintain enrollments in upper division electives. Cancelling courses that are offered in alternate year modes is damaging to students in programs such as the Environmental Studies minor and removes the ability of students to explore some of the non-core areas of chemistry. Students have commented that they do not want to register for some upper division electives due to the fear of those courses being cancelled.

## VI. PROGRAM PLANNING AND INITIATIVES

- The ETS Field Test for Chemistry is an imperfect instrument for assessing the quality of WOU chemistry graduates due to the coursework differences that are necessary to provide appropriate career preparation in the traditional chemistry and the forensic chemistry programs. Students in both options complete the same core requirements of general, organic and analytical chemistry. The students in the traditional option complete a three-term sequence in physical chemistry. Those in the forensic option take a one-term course in that discipline and are required to complete two terms of biochemistry. Biochemistry is a potential elective for the traditional majors and many students opt to take electives in other areas. All students are exposed to basic inorganic chemistry in the general chemistry sequence and more in depth coursework in this area is an elective available to students in either option, but is not a core requirement. The ETS exam major field test covers the areas of inorganic, analytical, organic, physical and biochemistry so we expect some lowering of scores in physical chemistry for students in the forensic option and in biochemistry for those in the traditional option who have not elected to take biochemistry. Scores in inorganic chemistry might be expected to be higher for those students who have opted to take elective courses in that discipline.

  Initiative: At the conclusion of the 2010-2011 academic year, administer the ACS Diagnostic of Undergraduate Chemistry Knowledge Exam that is designed for use at the end of an undergraduate chemistry major to assess the skills expected of an ACS certified chemist. Rather than being an exam that asks unrelated objective chemistry questions as the ETS exam does, the ACS exam is composed of a number of scenarios about which students answer questions. This test requires students to apply chemical concepts from

several core chemistry areas to a given scenarios. The solving of problems within different scenarios test critical thinking skills. This test will be in its third year of national use next year and the results will be able to be analyzed locally and compared to national norms.

Initiative: Attach a graduation requirement to the exit exam for graduating majors and add the description of the requirement to the university catalog

Planning: investigate the possibility of placing a minimum percentile score for graduation or having the percentile score attained permanently affixed to the student's transcript.

- We have administered the ACS exam for organic chemistry at the end of the three-term sequence to assess the learning of WOU students relative to national norms for more than five years.

  Planning: We are going to review a series of assessment exams available for measuring learning relative to national norms for other courses in our program. We will evaluate how closely those exams align to the course content taught in the 10 week quarter system as most exams are geared for the 15 week semester system. The ACS assessment exams are available for the following course offerings:
  - General Chemistry (for Ch 200 sequence) – exams available for measuring learning on a conceptual level, traditional (algorithmic) style or a pairing of the two approaches. Exams are available for evaluating on a term by term basis or for use at the end of the full year sequence.
  - General, Organic, Biochemistry (for Ch 100 sequence) – exams available for use at the end of the full year sequence or as the subsets of general, organic and biochemistry. National norms are only available for the full year exam
  - Biochemistry – an exam available for a one semester course that might be an appropriate instrument to assess our two term course sequence
  - Analytical Chemistry
  - Instrumental Analysis
  - Physical Chemistry – exams available to evaluate topical portions of physical chemistry content as well as a comprehensive exam

- Investigate possible ways to assess skills of students seeking entrance to the 100 and 200 sequences.

  Planning:
  - We will review commercially available diagnostic exams such as
    - The California Chemistry Diagnostic Test for Undergraduate Placement (diagnostic placement exam created by faculty from the University of California)
    - The Toledo Exam (an exam in three parts assessing math competency, general chemistry knowledge and specific primarily descriptive chemistry knowledge)
  - We will investigate the creation of a WOU specific exam
- Evaluate the Forensic Chemistry Option curriculum to ensure that the coursework provided at WOU follows the American Academy of Forensic Sciences (AAFS)

guidelines. Ultimately, we plan to apply for accreditation of our program from the AAFS.

- Seek a more multiculturally diverse student population within our programs

  Initiative:
  Write a Chavez grant for funding to do outreach within the Hispanic community

## VII. OTHER ITEMS

Student Successes:

Chemistry graduates in PhD graduate programs
Christina Demke (University of Utah)
Cory Perkins (Oklahoma State University),
Alvin Gatimu (Oregon State University)
Dale Purcell (John Jay College of Criminal Justice)
Jennifer Blaser (accepted to Colorado State University)

Shanley Young left John Jay to accept a position in the New York City crime laboratory

Traditional Chemistry major Shawn Decker was a recipient of a NASA scholarship for 2009-2010.

Notable Scholarship Activities:

Patricia Flatt with T. Mahmud presented a paper at the Oregon Academy of Sciences meeting entitled "Identification and Functional Analysis of the Pyralomicin Biosynthetic Gene Cluster"

Pete Poston completed a report to the National Park Service entitled "Final Report: Raman Spectroscopic Analysis of Rock Art Pigment from the Great Gallery, Maze District, Canyonlands National Park, Utah". In conjunction with this work, Dr. Poston participated in the filming of a National Geographic special on Canyonlands National Park. The special aired during Fall 2009.

Patricia Flatt co-authored two publications and obtained acceptance for a third publication.
Andrianasolo, E., **Flatt, P.M.,** McPhail, K.L., Simmons T. L., and Gerwick, W.H. (Accepted) Pivitol Connections: Tracing Support by the Natural Products Branch to Drug Discovery from Marine Organisms. *Proceedings of the Gordon Cragg Symposium*.

Fotso, S., Zabriskie, T.M., Proteau, P.J., **Flatt, P.M.**, Santosa, D.A., Sulastri, and Mahmud, T. (2009) Limazepines A-F, Pyrrolo[1,4]benzodiazepine Antibiotics from an Indonesian *Micrococcus* sp. *J. Nat. Prod.* 72(4): 690-695.

Wu, X., **Flatt, P.M.**, and Mahmud, T. (2009) Biosynthetic gene cluster of Cetoniacytone A, an unusual aminocyclitol from the endosymbiotic bacterium, *Actinomyctes* sp. LU9419. *ChemBioChem* 10(2):304-314.

Faculty-Student Research:

Patricia Flatt supervised research which resulted in the training of three undergraduate students (Jennifer East, Matthew McCrary, and Jeff Sigrist) , one master's student (Chloe'Mae Abbot) and one visiting professor (Chenyuan Li).

Pete Poston supervised two undergraduate projects:

- Development of a gold-sol nanosensor for methamphetamine
- Photolytic decomposition of the pollutant pntachlorophenol

Arlene Courtney supervised one undergraduate project in GC method development.

Service:

Arlene Courtney served as a sponsor/session chair for four 40 minute seminar presentations at the Academic Excellence Showcase and was a co-sponsor with Phillip Wade for the presentation of four student produced video documentaries at the AES.

Patricia Flatt chaired an Academic Excellence poster session in which three of her research students presented their work.

## VIII. PUBLIC RELATIONS ITEMS FOR PROGRAM PROMOTION

WOU chemistry graduate Alvin Gatimu (2008), currently a second year chemistry graduate student at Oregon State University, coauthored a paper entitled "Verwey-type transition within the $Pb_3RH_7$-x$Mn_xO_{15}$ Solid Solution" which appeared in The Journal of Solid State Chemistry. This paper was deemed sufficiently significant to be the cover story of the April issue of this prestigious journal.

## APPENDIX 1. FACULTY AND STUDENT ACCOMPLISHMENTS

## I. FACULTY AND STAFF ROSTER

Dr. Arlene Courtney, Professor and Department Chair
Dr. Pete Poston, Professor
Dr. Rahim Kazerouni, Associate Professor
Dr. Patricia Flatt, Assistant Professor
D. Spence Russell, Adjunct
Thomas Barnes, Adjunct & Head of OSP Portland Forensic Laboratory
Sara Short, Adjunct & scientist at OSP Portland Forensic Laboratory

## II. FACULTY HIGHLIGHTS

### a. Teaching

Patricia Flatt made substantial revisions to the existing laboratory sections for CH106. This included the introduction of two new laboratory experiments to the course and revision of several existing sections. The two new laboratory sections include an experiment 'Investigating the Activity of Enzymes' and an experiment entitled, 'DNA Isolation from Wheat Germ'. These changes were the beginning of alterations to the curriculum to accommodate the pre-nursing and forensic minor student populations. She also introduced the use of clickers for assessing student learning of presented material in the lecture part of the course.

Arlene Courtney and Phillip Wade collaborated in the use of project based learning in GS 203H (the LACC science course for honors students which is taught jointly through the Department of Earth and Physical Science and Chemistry). The course was taught using a Moodle framework and incorporating many Web 2.0 skills including the use of a wiki for collaborative student project development. Pairs of students created video documentaries of approximately 10 minute duration. These documentaries were aired in a public forum during the Academic Excellence Showcase. During this course extensive use was made of knowledge surveys. The data collected from these surveys will be used as part of a research publication on use of video production for teaching science. A poster session presentation is planned for the American Geophysical Union's Fall 2010 meeting.

### b. Scholarship

Patricia Flatt

- co-authored two papers and had a third paper accepted for publication.

Andrianasolo, E., **Flatt, P.M.,** McPhail, K.L., Simmons T. L., and Gerwick, W.H. (Accepted) Pivitol Connections: Tracing Support by the Natural Products Branch to Drug Discovery from Marine Organisms. *Proceedings of the Gordon Cragg Symposium*.

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- Co-authored one presentation

**Flatt, P.M**, and Mahmud, T. (2010) IDENTIFICATION AND FUNCTIONAL ANALYSIS OF THE PYRALOMICIN BIOSYNTHETIC GENE CLUSTER. Oral Presentation at the Oregon Academy of Science 69th Annual Meeting, Concordia University, Portland, OR.

- Authored or co-authored the grant applications

I. **COLLABORATIVE RESEARCH: CHARACTERIZATION OF THE RING CYCLIZATION REACTION MECHANISM DURING PYRALOMICIN BIOSYNTHESIS –** Joint grant proposal with Professor Mahmud from the College of Pharmacy at Oregon State University. Submitted in Jan 2010 to NSF requesting $98,986 over 3 years. Currently pending review.

**II. DEVELOPMENT OF ONLINE RESOURCES TO ENHANCE REMOTE/DISTANCE LEARNING OPTIONS IN THE HEALTH AND NATURAL SCIENCES –** Joint grant proposal with Professor Allen in the Physical and Health Science Division. Submitted to the Student Technology Committee at WOU. Awarded in the amount of $650.00

III. **ACQUISITION OF A SHAKER INCUBATOR TO ENHANCE RESOURCES AVAILABLE FOR BIOCHEMICAL AND MOLECULAR RESEARCH.** Joint proposal to the Academic Infrastructure Committee at WOU submitted by Prof. Flatt (Chemistry) and Prof Latham (Biology) to enhance independent research projects and several existing biology and chemistry laboratory courses. Awarded to the Department of Chemistry in the amount of $9,500.

Pete Poston

- Submitted a project report to the National Park Service (NPS) entitled "Final Report: Raman Spectroscopic Analysis of Rock Art Pigment from the Great Gallery, Maze District, Canyonlands National Park, Utah" an participated in the filming of a National Geographic Special highlighting this rock art. This report will be reformatted as a journal publication to be sent to *Applied Spectroscopy*
- Attended the Society of Western Analytical Professors held at the University of Utah Chemistry Department last Fall presenting the results of the rock art research
- Received a Category 3 Major Research Faculty Development grant funding another project with NPS regarding the radiometric dating and search for impact-related

nanodiamonds and Iridium that may have been created by an extraterrestrial comet strike that is theorized to have put an end to the Clovis Period of habitation ending approximately 13 ka ago

**c. Service**

Arlene Courtney

- Univeristy Freshman Year Experience Committee
- University LACC review Committee
- University Faculty Development Committee
- Chaired Department of Chemistry (Winter and Spring due to Fall sabbatical)

Rahim Kazerouni

- University Grievance Committee
- University PRC
- NSM Curriculum Committee
- Acting Department Chair Fall 2009

Pete Poston

- University Faculty Senate
- Chair Chemistry Adjunct Search Committee

Patricia Flatt

- University Student Conduct Committee
- NSM Seminar Committee
- NSM Technology Committee

## III. STUDENT ACHIEVEMENTS

- Jennifer Blaser accepted into Colorado State University Chemistry PhD program
- Shawn Decker recipient of NASA Scholarship
- Chemistry Student Seminars:
    - Jennifer East - Human Decomposition Chemistry
    - Kevin Swearingen - Glassifying Radioactive Waste for Long Term Storage
    - Shawn Decker – Modeling of Atoms With Hartree-Fock Theory
    - Jeff Sigrist – Characterization of Biosynthetic Pathways from *Frankia alni*
- Honors Student Video Documentary Titles:
    - Alyssa Schmidt and Diedra Cates – Biodiesel: The Fuel of the Future?
    - Jennifer Dicus and Joceline Wynn – A New Look At Hydroelectric Energy
    - Sierra Durfee and Maria Hommes – The Coast of Sustainability: Investigation of an Off-the-Grid Living Situation
    - Marina Jaschek and Melissa Wiener – Clean Coal: An Impossible Goal?
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- **APPENDIX 2. LAS Embedded Assessment Action Reports**

*Attach individual LAS Dean course embedded assessment logs, as available.*

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