



**University of Dayton  
Chemistry Department  
Assessment Plan  
August 26, 2012**

**Learning Outcomes**

The Chemistry Department has selected a set of assessment outcomes that map into the University-wide Learning Outcomes from *Habits of Inquiry and Reflection* as indicated below:

1. Scholarship: All undergraduates will develop and demonstrate advanced habits of academic inquiry and creativity through the production of a body of artistic, scholarly or community-based work intended for public presentation and defense.

*Chemistry Department Outcomes:*

- a. Knowledge and Research Skills Base Concomitant with Graduate School or Employment in the Chemical Industry. All CHM, BCM, MCM, and CHA majors will demonstrate the chemical knowledge base and research skills required for graduate school in chemistry and related disciplines, as well as for B.S.-level jobs in chemistry and chemically-related professions.

*Measures to be Utilized:*

- a. Undergraduate research and thesis.
  - i. Faculty-Directed Student Research Projects. All CHM and BCM majors will complete an original faculty-directed research project in which they demonstrate independent mastery of laboratory, computational, and data analysis skills appropriate to the project, as well as the ability to independently design experiments and execute basic laboratory procedures. MCM and CHA majors will also be encouraged to complete original faculty-directed research projects, though this is not a formal requirement for these programs.

The graduating class of 2012 consisted of 14 seniors (3 CHM, 9 BCM, 1 CHA, 1 Med/CHM). Of the students required to complete an original faculty-directed research project, 100% satisfied the requirement, prepared a senior thesis and presented a 20 minute seminar on their independent research projects. Thus, for this academic year, our department met the goal of having each CHM and BCM student satisfactorily complete a senior research project. A particularly strong aspect of our program is that our students generally conduct their research in the Chemistry Department.

During this cycle, 93% of our students worked in the department while a single student completed her research requirement outside of the department with UDRI/WPAFB support in the laboratory of Dr. Robota Heinz.

MCM and CHA majors who do not participate in faculty-directed student research will develop research skills in their instructional laboratory courses.

During this cycle, there were no senior MCM majors. One CHA major and one MED/CHM double major presented literature-based topics in CHM496. Both of these students demonstrated a solid understanding of the research discussed and of the skills necessary to accomplish the research.

Research skills may be developed in other venues (*e.g.*, industrial coops and/or internships, faculty-directed student research in other departments at UD or external academic institutions, research at the UDRI, WPAFB and other external government research agencies, *etc.*) when deemed appropriate by the Department Chair, the Academic Advisor, and the Undergraduate Research Director.

Two students presented seminars based on research conducted outside of the department. Each seminar was deemed satisfactory by those in attendance (faculty and students). They accordingly demonstrated the necessary research skills.

- ii. Senior Theses. Each research project will terminate with the composition and submission of a senior thesis. Each thesis will be reviewed and graded for CHM498/499 credit by the student's research advisor. At least 80% of the student researchers will demonstrate a solid understanding of fundamental chemical principles and laboratory instrumentation and procedures, as well as good technical writing skills in their thesis. All theses will be published in the annual Chemistry Senior Research Thesis binder.

The graduating class of 2012 consisted of 14 seniors (3 CHM, 9 BCM, 1 CHA, 1 Med/CHM double major). 93% of the senior theses based on original faculty-directed research projects were deemed satisfactory and published in the 2011-12 Annual Chemistry Senior Research Thesis book. In addition, one student submitted an unsatisfactory thesis (which was not published), another failed to submit a thesis (and accordingly failed to graduate), and yet another student submitted a satisfactory thesis (but failed to graduate due to poor performance in other courses). Thus, for the 2011-12 academic year, our department exceeded the goal of having 80% student researchers "demonstrate a solid understanding of fundamental chemical principles and laboratory instrumentation and procedures, as well as good technical writing skills in their thesis."

- b. Research Publications. At least 50% of the CHM and BCM majors will assist their faculty research advisors in the preparation and submission of manuscripts detailing their research to peer-reviewed journals, and will appear as co-authors on accepted publications.

Collectively, 22 articles and 2 book chapters (published or currently in review) were generated by the Chemistry Department in the period from January 1, 2011 to August 20, 2012. Of these, 8 had graduate coauthors and 5 had undergraduate coauthors, with 2 of the undergraduate coauthors graduating in 2012. Hence,  $2/15 = 13.3\%$  of our 2011-12 graduating seniors were co-authors on peer-reviewed publications, well short of our goal of 50%. This figure almost certainly underrepresents the total 2011-12 undergraduate co-authorship percentage, however, as additional publications from students graduating in 2011-12 are likely to appear in coming years.

- c. Research Presentations.

- i. All CHM, BCM, MCM, and CHA majors will deliver an oral presentation on a selected, faculty-approved literature topic which integrates chemistry, ethics, and values in the Professional Practice Seminar course (CHM 496). At least 80% of the students will demonstrate a sufficient understanding of scientific and ethical principles and oral communication skills during their presentations, as judged by evaluation forms completed by the Chemistry faculty.

During the fall 2011 semester, 18 students enrolled in CHM 496. 100% of whom presented satisfactory literature-based seminars, thereby surpassing the departmental goal of 80% of presenters demonstrating a sufficient understanding of scientific and ethical principles and oral communication skills. This being said, improvements are needed in assessment of student success, as the Department has not yet developed a standardized evaluation form for CHM496 literature seminar presentations—especially with regard to understanding ethical principles. This issue will be addressed in our “Actions Taken as a Result of Assessment” document.

- ii. All CHM and BCM majors will deliver a 15-20 minute oral presentation of their undergraduate research in the Research Seminar (CHM 497). At least 80% of the students will be judged to demonstrate a sufficient understanding of scientific principles and oral communication skills during their presentations, as judged by evaluation forms completed by the Chemistry faculty.

Of the 15 CHM and BCM majors presenting CHM497 research seminars in the spring of 2012, 14 (93%) delivered satisfactory presentations. The student who failed to present did not graduate or receive a degree. To this end, the departmental goal of 80% success was exceeded. This being said, improvements are needed in assessment of student success, as the

Department has not yet developed a standardized evaluation form for CHM497 research seminar presentations. This will be addressed in our “Actions Taken as a Result of Assessment” document.

- iii. At least 80% of Chemistry undergraduates engaged in research will present their results at the Stander Symposium.

Of the 9 Stander or Honors Symposium presentations delivered by students in the Chemistry Department in the Springs of 2011 and 2012, 6 involved undergraduates, with 3 of the undergraduate presentations being given by 2011 graduating seniors, 2 by 2012 graduating seniors, and 1 by a senior who failed to graduate in 2012. Accordingly, 25% (5/20) students who submitted senior theses in the springs of 2011 and 2012 presented at the Stander Symposium, far below our goal of 80%.

- iv. At least 50% of Chemistry undergraduates will deliver poster or oral presentations at local, regional, national and international conferences, such as ACS meetings, undergraduate research symposia, *etc.*

Collectively, 40 oral or poster presentations delivered by faculty and students in the Chemistry Department in the period from January 1, 2011 to August 20, 2012. Of these, 16 involved undergraduates, constituting ~30% of the undergraduates involved in research. This figure is far below the departmental goal of 50%.

d. Senior Exit Interviews and Alumni Questionnaire.

- i. At least 80% of CHM, BCM, MCM, and CHA majors will confirm that they feel prepared (in senior exit interviews) and were prepared (in Alumni Questionnaire) for graduate or professional school and/or employment in chemical or chemically-related industries.

Of the 25 students who took Senior Exit Interviews in the springs of 2011 and 2012, 21 (84%) felt adequately prepared for their future careers, 3 (12%) were ambivalent, and 1 (4%) felt unprepared. The departmental goal of 80% of students feeling adequately prepared for their future careers was exceeded.

The Alumni Questionnaire is not currently designed to accurately assess the level of career preparation provided by the UD Chemistry Department. This issue will be addressed in our “Actions Taken as a Result of Assessment” document.