

Assessment Plan

Department of Chemistry and Biochemistry

I. Mission Statement

The Calvin College Department of Chemistry and Biochemistry seeks to engage in chemical/biochemical education and research that takes seriously the Creator's invitation to explore and investigate the atomic/molecular features of the world, and to provide a Christian model for its study, stewardly use, and keeping.

An elaboration of the department mission statement, including educational outcomes, can be found in the document, "Calvin College Department of Chemistry and Biochemistry Mission Statement".

II. Five-year Assessment Plan

A five-year assessment plan is proposed below. The plan includes annual tasks (record-keeping, use of national standardized exams, and alumni and senior surveys), department evaluation of three areas of assessment (communication skills, laboratory, and integrative knowledge), department evaluation and review of a 5-year assessment summary report, and external review by the American Chemical Society.

A. Annual assessment tasks and record-keeping

Assessment	Method
1. American Chemical Society (ACS) standardized exams: Chem 104, Chem 262, Chem 201, Chem 317/304	Faculty administer ACS exams as the final exam in the course; dept secretary collects results
2. ETS Major Field Test in Chemistry	Assessment committee administers exam; graded by ETS
3. Data on post-graduation plans, including med/grad school admissions and post-graduation employment	Dept chair or secretary collects information
4. Record of Chem 295 seminar titles/speakers/institutions	Faculty member assigned to Chem 295 responsible for archiving updated seminar schedule on Web
5. Record of departmental research students and their projects or internships: Chem 104 Honors, Chem 395, Chem 390, and summer research or internship (at Calvin and at other institutions and companies)	Dept secretary collects information yearly
6. Senior survey and 5-year alumni survey	Developed in conjunction with Social Research Center and Alumni Office; administered by Social Research Center

7. Record of chemistry students serving as teaching assistants	Dept secretary collects information yearly
8. Record of outreach activities done by students	Dept secretary collects information yearly
9. Record of students graduating with honors in chemistry and biochemistry	Dept chair or honor's liason collects information

B. Year I assessment goals (2004-2005)

1) Writing program assessment

- a) Critique of current curriculum with respect to communication and literature outcomes.
- b) Assessment of a selected writing and/or oral presentation assignment in sophomore, junior and senior-level classes. The writing assessment will be done by departmental committee on a student sampling of one assignment from each course. The oral presentation assessment will be done by the course instructor.
 - i) Chem 262 formal lab report on synthesis project
 - ii) Chem 323 literature assignment
 - iii) Chem 395 final report
 - iv) Chem 324 oral presentation
- c) Department discussion of writing program assessment.

2) Senior and alumni surveys:

- a) Work with social research center and alumni office to develop questionnaire for exiting seniors and 5th-year alumni
- b) Use questionnaire for 2005 graduating class and first alumni group in the spring of 2005

C. Year 2 assessment goals (2005-2006)

1) Laboratory assessment

- a) Critique of current curriculum with respect to laboratory outcomes.
- b) Assessment of a selected laboratory assignment in freshman, sophomore, junior, and senior-level classes (evaluation done by instructors in these courses):
 - i) Chem 104
 - ii) Chem 201
 - iii) Chem 317/304
 - iv) Chem 383
- c) Department discussion of laboratory program assessment.

2) Senior and alumni surveys

- a) Modify survey questions as needed in consultation with social research center
- b) Use survey for 2006 graduating class and second alumni group

D. Year 3 assessment goals (2006-2007)

- 1) Integrative knowledge assessment
 - a) Critique of current curriculum with respect to integrative knowledge outcomes.
 - b) Assessment of a selected integrative knowledge assignment in the senior capstone course (evaluation done by instructor in this course):
 - c) Department discussion of integrative knowledge assessment.

E. Year 4 assessment goals (2007-2008)

- 1) Overall program assessment
 - a) Use assessment data collected over the last four years to write a summary report to be presented to department in the fall of 2008.

F. Year 5 assessment goals (2008-2009)

- 1) Overall program assessment
 - a) Department review of assessment report.
 - b) Department recommendation of goals for next assessment period.
- 2) ACS accreditation report
 - a) Accreditation report for American Chemical Society reviewed by the department and submitted to the ACS.
 - b) Review of response by ACS to accreditation report.

III. Assessment criteria

The assessment tools in the table below are grouped according to the educational outcome category. Part IV in this document shows how the educational outcomes in the departmental mission statement are grouped into these categories.

Assessment tool	Timing	Criterion
(1) Knowledge and Problem Solving		
a. American Chemical Society (ACS) standardized exams for selected major's courses: Chem 104, Chem 262, Chem 201, Chem 317/304.	Annual – standardized exam	Mean score at least in the 60% percentile
b. ETS Major Field Test in Chemistry	Annual – standardized exam	Mean score at least in the 50% percentile.
c. Data on post-graduation plans, including med/grad school admissions and post-graduation employment	Annual-record keeping	Graduates will be accepted to graduate and medical school programs or will get jobs as BS chemists and biochemists and as secondary education teachers or other choice
d. Post-grad survey question	Annual-survey	80% of students feel that Calvin prepared them adequately in chemical knowledge and problem-solving
(2) Integrative Knowledge		
a. Key assignment in capstone course – evaluated by instructor	2006-07	75% of students will satisfactorily meet all components of the grading rubric
b. Critique of current curriculum with respect to integrative knowledge outcomes	2006-07	Integrative knowledge outcomes are being achieved over the curriculum as a whole
c. Senior exit survey and post-grad survey questions	Annual - survey	80% of students feel that Calvin helped them understand integrative issues
e. Record of Chem 295 seminar titles/speakers/institutions	Annual-record keeping	Over a five-year period, Chem 295 seminars will include topics in current research, vocational issues, and integration of faith and science, presented by speakers with a diversity of scientific and ethnic backgrounds

Assessment tool	Timing	Criterion
<p>(3) Laboratory</p> <p>a. Evaluation of a key laboratory assignment in Chem 104, Chem 201, Chem 317/304, and Chem 383 by course instructor(s)</p> <p>b. Record of departmental research students/projects: Chem 385, 390, and 395; summer research projects and internships at Calvin and elsewhere</p> <p>c. Critique of current curriculum with respect to laboratory outcomes.</p> <p>d. Post-grad survey questions</p>	<p>2005-06</p> <p>Annual – record keeping</p> <p>2005-06</p> <p>Annual - survey</p>	<p>75% of students will satisfactorily meet all components of the grading rubric</p> <p>60% of graduating seniors will have done at least one research project or internship</p> <p>Laboratory outcomes are being achieved over the curriculum as a whole</p> <p>80% of graduates will feel that Calvin prepared them adequately in laboratory outcomes.</p>
<p>(4) Communication/Literature skills</p> <p>a. Chem 262 formal lab report, Chem 323 literature report, and Chem 395 final report evaluated by departmental committee; oral presentation assignment in Chem 324 evaluated by course instructor</p> <p>b. Critique of current curriculum with respect to communication and literature outcomes.</p> <p>c. Post-grad survey questions</p>	<p>2003-04</p> <p>2003-04</p> <p>Annual - survey</p>	<p>Writing and literature outcomes are being achieved over the curriculum as a whole</p> <p>80% of graduates will feel that Calvin prepared them adequately in communication and literature research skills</p>
<p>(5) Virtues</p> <p>a. Senior exit survey and post-grad survey</p>	<p>Annual - survey</p>	<p>80% of graduates will agree with virtue outcomes</p>

IV. Department Mission Statement: Categorization of Educational Outcomes

This table shows how the educational outcomes in the department mission statement can be classified in several categories. These categories are used to organize the assessment tools in part III and the assessment plan in part II of this document.

Mission Statement Educational Outcomes	Category
<p>A. All of our students, both majors and non-majors, should be able to demonstrate an ability to:</p> <ol style="list-style-type: none"> 1. recall basic chemical knowledge. 2. understand chemistry as an important way of interpreting and understanding our world. 3. do creative problem solving using the technical, scientific, and intellectual skills that they have acquired. 4. organize and access scientific knowledge using chemical understanding, tabular data, graphs, mathematical relationships, and structural representations. 5. learn to appreciate science, and develop attitudes and virtues appropriate for their future role of shaping contemporary society. 	<p>Knowledge</p> <p>Knowledge-integrative</p> <p>Problem-solving (skill)</p> <p>Problem-solving (skill)</p> <p>Virtue</p>
<p>B. Students graduating with a major in chemistry or biochemistry should be able to demonstrate an ability to:</p> <p>B-i: display proficiency in applying scientific methods in the laboratory:</p> <ol style="list-style-type: none"> 1. design experiments to answer questions or test hypotheses. 2. perform reliable experiments 3. develop the synthetic skills to create new knowledge by deriving relationships, modeling, predicting, etc. 4. analyze the results and draw conclusions from experiments. 5. report on the experiments and the results in written and oral formats. 6. work as a participating member of a team. 	<p>Laboratory-knowledge</p> <p>Laboratory-skill</p> <p>Laboratory-synthesis (skill, knowledge)</p> <p>Laboratory-analysis (skill, knowledge)</p> <p>Laboratory-communication</p> <p>Laboratory-(skill, virtue)</p>

Mission Statement Educational Outcomes	Category
<p>B-ii: develop the specific technical, scientific, and intellectual skills necessary to facilitate creative problem solving:</p> <ol style="list-style-type: none"> 1. computational skills: to facilitate an appropriate use of mathematics as a way of expressing physical and chemical relationships. 2. laboratory skills: to become proficient in instrumental techniques of gathering data, to separate and purify substances, and to interpret spectral data as a means of determining chemical structures and sample purity. 3. library skills: to increase proficiency in searching the literature. 4. computer skills: to facilitate an appropriate use of computers in computations, in laboratory, and literature searching. 5. communication skills: to present ideas effectively in appropriate ways such as writing laboratory reports, presenting oral reports, and presenting information. 	<p>Problem-solving (skill)</p> <p>Laboratory-skill</p> <p>Literature research-skill</p> <p>Computer-skill</p> <p>Communication-skill</p>
<p>B-iii: develop appreciation for chemistry and its appropriate role in shaping contemporary society.</p> <ol style="list-style-type: none"> 1. understand the methods and limitations of chemistry (science), the nature of chemical theories and facts, and the developmental character of chemistry/bio-chemistry by exposure to the current literature, the departmental seminar program, and the departmental capstone course. 2. view themselves positively as Christians equipped with knowledge, skills, attitudes and virtues that will allow them to exercise responsible service as students and in their future scientific profession. <ul style="list-style-type: none"> • integrate virtues such as honesty, diligence, and stewardship into their scientific practice. • foster enthusiasm for communicating chemistry and biochemistry. • foster the inclusion of under-represented groups in chemistry and biochemistry. • provide a collegial and supportive environment for fellow chemistry students, both male and female. 	<p>Knowledge-integrative</p> <p>Virtue</p> <p>Virtue</p> <p>Virtue</p> <p>Virtue</p>