

Department of Chemistry and Biochemistry Assessment Activities 2003-04

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Department of Chemistry and Biochemistry Assessment Committee.

The department of chemistry and biochemistry has accomplished the following assessment activities this past year (2003-2004):

- I. **Approval of an expanded mission statement** by the chemistry department in October, 2003. This statement describes departmental student learning objectives for chemistry and biochemistry majors and other students of the department.
- II. **Approval of an assessment plan** by the chemistry department in April, 2004. The assessment plan outlines a five-year plan to assess the departmental student learning objectives, describes the correlation between the departmental student learning objectives and the planned assessment activities, and outlines criteria for the various assessment activities.
- III. **The following assessment activities** have been accomplished in the 2003-2004 academic year. These activities fall under two categories in our departmental plan: (a) annual assessment tasks and (b) five-year cycle assessment activities. Since the first year of our five-year plan is 2004-05, we report progress made on the year 1 assessment activities.

A. 2003-04 Assessment Tasks and Record-keeping. The following table shows the annual assessment tasks that were accomplished this year and compares the results to the criteria as stated in the department assessment plan for the learning objectives.

Assessment categories and tasks	Assessment criteria and 2003-04 results
(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.	Mean score at least in the 60% percentile. 2003-04 results: Chem 104: 76th percentile Chem 262: 74th percentile Chem 317: 96th percentile Chem 318: 90th percentile
b. ETS Major Field Test in Chemistry	Mean score at least in the 50% percentile. 2003-04 results: 65th percentile

Assessment categories and tasks	Assessment criteria and 2003-04 results
c. Data on post-graduation plans, including med/grad school admissions and post-graduation employment	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 See note (ii) below
(2) Integrative Knowledge	
e. Record of Chem 295 seminar titles/speakers/institutions	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 2003-04 (23 seminars total): vocational issues (1), current research (16), integration of faith and science (1), women speakers (6), minority speakers (2), student speakers (5)
(3) Laboratory	
b. Record of departmental research students/projects: Chem 385, 390, and 395; summer research projects and internships at Calvin and elsewhere	60% of graduating seniors will have done at least one research project or internship 2003-04: data gathering and analysis in progress; 15 students did summer research projects in the chemistry department (see table in Appendix B)

Notes:

(i) Knowledge and problem solving learning objectives are assessed through items 1a, 1b, and 1c above. These indicators show that we are meeting these learning objectives. The department will be reviewing these indicators as we continue to collect yearly data, but especially in years 4 and 5 of the 5-year plan. These indicators will also be used by instructors in various courses to help evaluate the effects of curriculum revision, particularly in Chem 103-104 as we have plans for this course to undergo revision in the next two years.

(ii) Graduate school, medical school, and secondary education assessment:

(a) Graduate school: Each year a number of our graduates continue their studies in graduate school pursuing a Ph.D. degree. Included in the list of graduate schools that they have attended over the past 5-6 years are some of the best in the nation: University of Wisconsin-Madison, University of Washington, University of Michigan-Ann Arbor, Indiana University, Pennsylvania State University, University of Illinois-Urbana, and California Institute of Technology. When excellent universities accept our students, they, in effect, are giving a stamp of approval to our programs in chemistry and biochemistry. The Graduate Record Exam (GRE) scores of those that wrote the general tests and/or the subject test starting

with the 1998-99 academic year are given in **Table A.1** of Appendix A. Note the overall mean of the subject tests is in the 64th percentile and one student scored in the 97th percentile.

- (b) Medical school: Since premedical students generally take five courses in our department, their performance in the Physical Sciences section of the Medical College Aptitude Test (MCAT) provides us with an external evaluation of our courses in general chemistry, organic chemistry, and biochemistry, along with the two courses that they take in physics. Each year, 15-25 Calvin students write this test and the mean scores from the past 5 years are summarized in **Table A.3** of Appendix A. The mean scores of the Calvin students in the physical science section of the MCAT are in the range 7.9-10.3. For comparison, the mean score nationally of all the persons who wrote this part of the test in 2002 is 8.0, which is very close to the overall mean from each test. Generally, the scores of the Calvin students are significantly higher than the overall mean, sometimes by over two points. We take the above data to provide a strong positive assessment of the chemistry content that our premedical students are learning by taking courses in our department.
- (c) Secondary Education: Each year students who seek certification for teaching high school chemistry must pass a subject area test prepared and administered by the State Department of Education. The results for Calvin's secondary education chemistry majors are shown in **Table A.4** of Appendix A, and compared with the state-wide performance of students writing this test. Of those students writing the test in the last four years, only one Calvin student did not pass on the first try and that student was successful upon repeating the test. Such results provide a strong positive assessment of the content preparation of our secondary education chemistry majors.

Progress on communication and research literature assessment goals for 2004-05. The department began working on assessment of communication and literature fluency learning objectives, with full assessment to be completed in 2004-05. The current curriculum was critiqued in 2003-04 by evaluating the types of written communication, oral communication, and literature assignments that are currently being used across the chemistry curriculum. The results of this were discussed at a department meeting in March, 2004. The writing program as a whole will be discussed after the full assessment in 2004-05, but two concerns were noted at the March 2004 meeting: First, although the department believes it requires an appropriate variety of written and oral communication assignments at the 200 and/or 300-level, written assignments at the 100-level are not assigned consistently. Second, there were concerns regarding the research-literature fluency of our students. While some courses require reading in the primary literature, the department believes that training in literature searching is currently inadequate in our current curriculum. As an immediate response to this, some faculty will be working on literature searching assignments for their courses, such as physical chemistry (Chem. 317).

Appendix A
GRE, Major Field Test, MCAT, and State Certification Examination Results

Table A.1
Department of Chemistry and Biochemistry
Graduate Record Examination Results

Academic Year	Number of Students (Subject)	Verbal Percentile (Mean)	Quantitative Percentile (Mean)	Analytical Percentile (Mean)	Subject Test Percentile ^{***} Range (Mean)
1998-99	3 (chem)	86	94	94	64-97 (80)
2000-01	5 (chem)	69	76	76	42-84 (60)
2000-01	1 (biochem) [*]	91	78	69	87 (87)
2001-02	1 (biochem)	45	82	54	11 (11)
2002-03	1 (biochem) ^{**}				52 (52)
2003-04	1 (chem)	67	90		84 (84)
* One student wrote the General Test only; ** Subject Test only; *** Overall mean = 64.5					

Table A.2
Chemistry Major Field Test Results

Academic Year	Number Students	Total Mean (Percentile)	Physical Mean (Percentile)	Organic Mean (Percentile)	Inorganic Mean (Percentile)	Analytical Mean (Percentile)
2001-02	10	165.4 (88)	64.7 (88)	67.7 (93)	56.1 (68)	59.8 (82)
2002-03	5	153.0 (66)	47.8 (54)	56.4 (72)	49.8 (59)	50.6 (62)
2003-04	14	152.7 (65)	48.8 (57)	53.1 (68)	51.6 (65)	48.8 (58)

Table A.3
MCAT Scores from Calvin Students

Test Date	Verbal	Biological	Physical	Written
4/98	9.2	10.0	10.3	Q
8/98	9.0	10.3	9.7	Q
4/99	9.4	10.7	10.1	P
8/99	8.8	8.1	8.7	O
4/00	8.3	9.7	9.3	O
8/00	8.3	8.9	9.2	P
4/01	9.8	10.5	10.2	Q
8/01	9.8	10.2	9.3	O
4/02	8.9	9.7	9.1 [*]	Q
8/02	8.3	9.6	7.9 [*]	Q
4/03	9.9	9.9	9.3	Q
4/04	9.3	9.0	9.9	P
* Mean score in physical sciences is 8.0 for the 57,539 students who took the 4/02 and 8/02 tests.				

Table A.4
State Certification Test in Chemistry for Secondary Education

Students	Year	# Writing	# Passing	% Passing
Calvin College	2001	6	5	83
State-wide		374	247	66
Calvin College	2002	7	7	100
State-wide		371	243	65
Calvin College	2003 (partial)	4	4	100
State-wide		97	72	74
Calvin College	2003-04	3	3	100
State-wide				

Appendix B
 Department of Chemistry and Biochemistry
 Summer Research Activities
 2004

<i>Faculty</i>	<i>Student</i>	<i>Title</i>	<i>Funding</i>
Eric Arnoys	Peter Hoekman	Proteins involved in nuclear import and export	Merck
Eric Arnoys	Nick Be	Folding and stability of Galectin-3	HHMI
Eric Arnoys	Elisa Verde	Nuclear localization of galectin-3	Research Corp
Eric Arnoys	Rianna VanderGaast	Measuring the rate of protein diffusion within a living system	Research Corp
Ron Blankespoor	David Rubush	In Search of an Enantioselective Synthesis of Aldehydes Using a Photochemical Method	Science Division Jansma Fellowship
Ron Blankespoor	Stephanie Hogendoorn	Two Organic Experiments for the Journal of Chemical Education: A Multistep Synthesis using the Suzuki Reaction and HPLC Analysis of the Products from the Competitive Bromination of Benzene/Bromobenzene	Dirkse Summer Research Fellowship
Larry Louters	Tim VanderKooy	Effects of calcium channel blockers on glucose uptake	Merck
Larry Louters	Aaron Ten Harmsel	Effects of methylene blue on glucose uptake in fibroblast cells	HHMI on Merck
Darla McCarthy Arlene Hoogewerf	Deena Thomas Laura Zandstra	Effects of Pentachlorophenol on <i>Mycobacterium chlorophenicum</i>	Merck/AAAS HHMI Match
Darla McCarthy	Lia Wisnewski	Identification of Proteins Involved in Bacterial Pentachlorophenol Metabolism	Science Division Visser Family Fellowship
Kumar Sinniah	Tamar Hunse	Investigating Drug-DNA Interactions by Force Spectroscopy	HHMI (1/2 funding)
Kumar Sinniah	Mark VanderWal	Manipulating DNA Landscapes	HHMI
Douglas VanderGriend	Alissa Hare	Exerting Mathematical and Chemical Control to Rationally Synthesize Discrete and Infinite Coordination Networks	Science Division Jansma Fellowship
Douglas VanderGriend	Kelly Urness	Investigation and characterization of novel inorganic thermochromic materials.	