

## STUDENT LEARNING ASSESSMENT REPORT, BIOCHEMISTRY REVISED

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BRIEFLY DESCRIBE WHERE AND HOW ARE DATA AND DOCUMENTS USED TO GENERATE THIS REPORT BEING STORED:

THE DATA SUMMARY FOR THE 2015-2016 GRADUATING STUDENT SURVEY (GSS), THE ALUMNI SURVEY AND BIOLOGY/BIOCHEMISTRY DEPARTMENT EXIT EXAM HARDCOPIES ARE STORED IN THE DESK FILE DRAWER OF THE FACULTY MEMBER WHO PREPARED THE BIOLOGY ASSESSMENT REPORT IN THE MARYMOUNT ADMINISTRATION/ASSESSMENT FILES. THE INTERNSHIP DOCUMENTS AND COURSE DOCUMENTS ARE STORED IN HER OFFICE FILE CABINET, ARCHIVE BOX, AND THE DEPARTMENT CHAIR'S OFFICE. THE ELECTRONIC DOCUMENTS FOR PREVIOUS LEARNING ASSESSMENT REPORTS, GSS AND BIOLOGY DEPARTMENT EXIT EXAM ARE STORED IN HER OFFICE COMPUTER IN THE DESKTOP MARYMOUNT/ADMINISTRATION/ASSESSMENT FILES AND IN HER HOME COMPUTER UNDER DESKTOP/BARB/MARYMOUNTHOMEWORKINGUSE FILES/ADMINISTRATION/ASSESSMENT. HARDCOPIES OF ADDITIONAL DOCUMENTS ARE STORED IN HER OFFICE DESK AND WHITE CABINET.

### EXECUTIVE SUMMARY

List all of the program's learning outcomes: (regardless of whether or not they are being assessed this year)

Learning Outcome	Year of Last Assessment	Year of Next Planned Assessment
Demonstrate foundational knowledge in general biology, genetics, cell biology, general chemistry, and organic chemistry, biochemistry, and physics.		2016-2017
Critically evaluate and interpret scientific literature in a professional setting and communicate that knowledge to a professional audience.		2016-2017
Plan and safely conduct laboratory exercises common in biochemistry.		2017-2018
Demonstrate the ability to apply knowledge gained in solving problems in new and immerging areas of biochemistry.		2017-2018

**Describe how the program's outcomes support Marymount's Mission, Strategic Plan, and relevant school plan:**

The Biochemistry program was recently developed to expand the major offerings in the natural sciences, and was included in the Arts and Sciences strategic plan as a major, which would promote gender balance. It is designed to be a rigorous undergraduate academic program, which prepares students for careers in the lab sciences and as preparation for graduate programs in biochemistry, and professional programs in health sciences such as medical school, dental school, and pharmacy school. (Strategic Plan Goal: Offer rigorous, cohesive, integrated undergraduate and graduate curricula that produce superior graduates able to succeed in their positions and communities.) The program begins with foundational courses in biology and chemistry, which are also components of the biology major. These shared courses also include BIO 300, Writing for Science, and BIO 410, Senior Seminar, which improve the students technical writing and presentation skills, introduce them to the current scientific literature, and emphasize ethics in science. The program culminates in advanced biochemistry lecture and laboratory and physical biochemistry. These courses are designed to introduce students to recent advances in the theory and practice of biochemistry. In these courses they will hone their skills as scientific researchers. Finally in their senior year, students are required to have an internship experience to apply their learning.

**Provide a brief description of the assessment process used including strengths, challenges and planned improvements:**

This is the first year with graduates in this program. There are only two students, and both of these students began as Biology majors and transferred to the Biochemistry program. Therefore in this report we only have data from two of our assessment instruments, the senior exit exam and from the course BIO 410. There is no separate data for biochemistry majors as freshmen in BIO 151-152. Therefore for this first (and the next 3 assessments) we will compare the graduating biochemistry majors with all freshmen taking the course BIO 151-152, and BIO 300.

In the future we will use selected questions from a senior exit exam, internship evaluations, alumni and graduating senior surveys, as well as the information from classes as our majors move through the program as direct and indirect measures. Courses which currently have assessment instruments are BIO 151-152 General Biology for Majors, BIO 300 Writing for Science, and BIO 410 Senior Seminar and these items are used as direct measures. We will add several strong indirect measures, including selected questions from internship evaluations, the Graduating Senior Survey (GSS) and the University and Biology Department Alumni Surveys.

This first cycle we are assessing "demonstrate foundation knowledge in biology and chemistry" directly by the senior exit exam and indirectly using the DAT (Discovery Assessment Tool) rubrics from the students senior seminar presentation, and we are also assessing "critically evaluate and interpret scientific literature in a professional setting" using the DAT (Discovery Assessment Tool) rubrics from BIO 410 as a direct measure, and the research question from the senior exit exam as an indirect measure.

*The Exit Exam Research Reading section consisted of four questions, #90 – #93 and Figure 1. Please see Appendix 4 for the Exit Exam questions and the figure and Appendix 5 for the Exit Exam Instructions and Introductory Script.*

*The BIO 410 Senior Seminar Presentation consists of an hour long research talk on a topic of current interest in biology/biochemistry. Each student must present a talk. They are required to use sources from the peer-reviewed primary literature and interpret this in a professional presentation and discussion setting for their peers.*

We used the following DAT elements to assess the Senior Seminar Presentations. These elements were selected for the assessment because the students would need the foundational knowledge in biology and chemistry to prepare a presentation for their professional peers which is at the rubric assessment level of a 4.0, as described for each element below:

**Context:**

Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work

**Gathers the Needed Information:**

Presents thorough and relevant coverage of existing knowledge

**Evaluates Information:**

Evaluates information and its sources based on a wide variety of relevant criteria as they relate to a particular discipline.

In particular, the sources must be taken from the current primary literature, and be interpreted correctly for the students to receive the necessary scores.

The strengths of our assessment process are that we have structures in place such as the senior exam and the assessments already being done in BIO 151, BIO 300 and BIO 410 for the Biology, B. S. program. The challenges are the lack of historical data, and alumni survey results, which will persist for several years into this new program. The planned improvements are listed below:

1. Refine Outcomes: The current outcomes were selected by comparison with other institutions and also for ease of assessment with the currently available assessment tools. More faculty input is needed to determine if these are optimal.
2. Refine assessment tools to best measure the refined outcomes. In particular, the DAT is a general inquiry rubric and is not necessarily the best to assess scientific inquiry. One possible improvement is to use a different rubric developed specifically for science programs. Also the senior exit exam was developed for students in the Biology, B. S. and based on the existing curriculum of our department. Currently, it is not possible to compare our graduates with graduates of other institutions. We should examine using an exit exam such as those provided by the American Chemical Society or ETS, which would allow us to compare our results with other institutions.
3. The current assessment instruments used may need to include an identifier for students who are declared as biochemistry majors.
4. Add information from alumni surveys as acquired.

**Describe how the program implemented its planned improvements from last year:**

This is the first assessment of the program.

**Provide a response to last year's University Assessment Committee review of the program's learning assessment report:**

This is the first assessment of the program.

**Outcome**

**Learning Outcome 1.** Demonstrate foundational knowledge in biology and chemistry

**Assessment Activity**

<u>Outcome Measures</u> Explain how student learning will be measured and indicate whether it is direct or indirect.	<u>Performance Standard</u> Define and explain acceptable level of student performance.	<u>Data Collection</u> Discuss the data collected and student population	<u>Analysis</u> 1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.
<b>Learning Outcome 1 Foundational Knowledge</b>  <b>Direct Measures</b> Exit exam scores from the general biology, genetics, cell biology, general chemistry, and organic chemistry sections.	Average student score will be 60% or better on each foundation knowledge section. (This would be comparable to a score of 60 on the Biochemistry GRE, and place our graduates above the 70 <sup>th</sup> percentile for students taking the GRE.	The exit exam is a comprehensive multiple choice exam written by Marymount University faculty. The exit exam is administered as an on-line survey by the Office of Planning and Institutional Effectiveness with the help of a Biology and Physical Sciences Department faculty in mid-April. The score is reported as percent correct for specific sections of the exam. Two students who were initially biology majors are included in this assessment.	1) The Office of Planning and Institutional Effectiveness tabulated the data analysis for the exit exam. A Biology and Physical Sciences faculty member analyzed the data.  2) The results for the two students graduated in SP 2016 are presented in Table 1. Both students met the performance standard in general biology, cell biology, general chemistry, and organic chemistry. One student met the standard in genetics and one student scored 50%-not meeting the performance standard. The average student score was above 60%. <u>The performance standard was met.</u>
<b>Learning Outcome 1 Foundational Knowledge</b>  <b>Indirect measure:</b> <b>Selected elements from the DAT assessment from BIO 410 Senior Seminar: context, gathers needed information, and evaluates information</b>	An acceptable level of performance is an average score of 4.0 or greater for all students.	The data is collected in BIO 410 senior seminar. The faculty instructor evaluates this presentation using the DAT rubric and assigns a number from 1-5 for each DAT element.	1) The Biology and Physical Science faculty tabulate the DAT rubric data. A Biology and Physical Science faculty member analyzed the results.  2) The results for the 2 students graduated in SP 2016 with degrees in Biochemistry are shown in Table 2. The standard was met for context and gathers information with the average scores being 4.5 and 5.0 respectively. The score was 3.75 for evaluates information, which did not meet the standard. The average score was 4.4 <u>The students met the standard.</u>

### Interpretation of Results

#### **Extent this Learning Outcome has been achieved by students**

Based on the small sample size, this learning outcome is largely met.

#### **Program strengths and opportunities for improvement relative to assessment of outcome:**

Based on the small sample size, the program provides the students with strong foundational knowledge in biology and chemistry.

#### **Discuss planned curricular or program improvements for this year based on assessment of outcome:**

At this time, the planned curricular and program improvements are in the advanced course work and laboratory experiences. There are no planned improvements in the foundational courses.

### Outcome and Past Assessment

#### **Learning Outcome 2:**

**Critically evaluate and interpret scientific literature in a professional setting.**

### Assessment Activity

<u>Outcome Measures</u>	<u>Performance Standard</u>	<u>Data Collection</u>	<u>Analysis</u>
Explain how student learning will be measured and indicate whether it is direct or indirect.	Define and explain acceptable level of student performance.	Discuss the data collected and student population	1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.
<b>Learning Outcome 2:</b> <b>Critically evaluate and interpret scientific literature in a professional setting</b>  <b>Direct Measures,</b> Research Interpretation section of the exit exam	Participating students will achieve an average score of 50% or more correct of the available points on the research interpretation section of the Exit Exam.	The exit exam is a comprehensive multiple choice exam written by Marymount University faculty. The exit exam is administered as an on-line survey by the Office of Planning and Institutional Effectiveness with the help of a Biology and Physical Sciences Department faculty in mid-April. The score is reported as percent correct for specific sections of the exam. Two students who were initially biology majors are included in this assessment. Please see Appendix 4 for the Exit Exam questions and the figure and Appendix 5 for the Exit Exam Instructions and Introductory Script.	1) The Office of Planning and Institutional Effectiveness tabulated the data analysis for the exit exam. A Biology and Physical Sciences faculty member analyzed the data. The average percent of correctly answered Research Reading questions was used to assess if the students met the acceptable level of performance.  2) Both students received 25% correct. Thus the average score was 25%. <u>Neither student met the performance standard.</u>

<u>Outcome Measures</u> Explain how student learning will be measured and indicate whether it is direct or indirect.	<u>Performance Standard</u> Define and explain acceptable level of student performance.	<u>Data Collection</u> Discuss the data collected and student population	<u>Analysis</u> 1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.
<b>Learning Outcome 2:</b> <b>Critically evaluate and interpret for others scientific literature</b>  <b>Direct Measures, DAT scores from the Senior Seminar Course BIO 410</b>	An acceptable level of performance is an average score of 4.0 or greater for all students.	The two students graduating in Biochemistry SP2016, were evaluated using the DAT by the faculty member teaching Senior Seminar in FA 2015 and SP 2016.	1) The Biology and Physical Science faculty tabulate the DAT rubric data. A Biology and Physical Science faculty member analyzed the results.  2) The results for the 2 students graduated in SP 2016 with degrees in Biochemistry are shown in Table 2. The students met or exceeded the performance standard in all categories except evaluating information, where the average score was 3.75. Thus average student score was above the acceptable level of performance and the performance standard was met.

Interpretation of Results

**Extent this Learning Outcome has been achieved by students (Use both direct and indirect measure results):**

This learning outcome was not met at all by the results from the senior exit exam, and not completely met by the results from the senior seminar.

**Program strengths and opportunities for improvement relative to assessment of outcome:**

Most of the required upper division courses where this type of learning takes place are newly developed courses, which have been offered once or at most twice before. Faculty, teaching these courses, are committed to improving the program, and are currently developing more complex laboratory experiences for the students.

**Discuss planned curricular or program improvements for this year based on assessment of outcome:**

Curricular improvements are planned for the course CHM 441 Physical Biochemistry. Activities and assignments, which require reading and interpreting results from the primary, peer reviewed literature will be added to the curriculum.

**Table 1. Exit exam percent correct results for the different sections.**

Table 1 Exit Exam Results Percent Correct by Section								
ID	Intro Biology	Microbiology	Genetics	Cell Biology	General Chemistry	Organic Chemistry	Physics I & II	Reading Research
2346674	60.00%	60.00%	70.00%	60.00%	64.29%	66.67%	66.67%	25.00%
2351010	73.33%	30.00%	50.00%	80.00%	64.29%	66.67%	66.67%	25.00%

Table 2. BIO 410 Senior Seminar DAT element results based on a score range of one to four.

Table 2 DAT Assessment results	Bio151			Bio300/368			Bio410
	Bio151, 2013-2014	Bio 151, 2014-2015	Bio151, 2015	Bio300/368, 2013-2014	Bio300/368, 2014-2015	Bio300/368, 2015-2016	Bio410, 2015-2016
Focus	3.1	3.4	3.9	4.1	4.4	3.4	5.0
Context	3.2	3.3	3.7	4.1	4.6	3.3	4.5
Gathering Information	2.8	2.8	2.6	4.0	4.4	3.0	5.0
Evaluating Information	2.8	3.0	2.7	4.2	4.1	3.0	3.75
Use of Information	2.8	3.1	2.9	4.0	4.3	3.0	5.0
Design Process	3.0	3.4	4.0	4.1	4.1	3.5	4.5
Connections Among Ideas	2.9	3.2	3.6	3.9	4.2	3.4	5
Conclusions	3.1	3.3	3.9	4.0	4.3	3.5	5
Content	2.9	3.2	3.9	3.9	4.3	3.4	4.5
Average DAT score for Learning	2.9	3.2	3.4	4.0	4.3	3.3	4.82
Number of students	64	58	39	31	25	33	2