

**2017-2018 ASSESSMENT REPORT
PROFESSIONAL SCIENCE MASTERS IN BIOTECHNOLOGY
GRADUATE PROGRAM**

1. Program: PSM in Biotechnology
Graduate program
College of Arts and Sciences Division (Sciences)
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Mission Statement

2. **Mission Statement** (no changes made since October 2017):

Our Mission is to provide motivated students with the knowledge and skills needed to successfully enter a career in the biotechnology industry.

Program Learning Outcomes

3. **PSM in Biotechnology Program Learning Outcomes** (no changes made since October 2017):
 1. Interpret concepts from multiple disciplines (biology, bioinformatics, business) within biotechnology.
 2. Perform best practices and biotechnology-related laboratory techniques.
 3. Articulate the need for ethics in science and technology based business/research/industry.
 4. Critically review scientific papers and demonstrate communication skills appropriate for professional level employment in science and technology based business/research/industry.
 5. Network with industry members in molecular biology and biotechnology based business/research/industry.

Brief Summary of Most Recent Assessment Plan

4. **Most recent assessment report feedback:**

The most recent yearly assessment report for 2016-2017 was submitted in October of 2017 by the former Program Director, Prof. Jennifer Dever. Assessment of PLO1 was performed by direct assessment of student assignments from two Biotechnology program classes – BTEC620 and BTEC685/686.

There were several areas of the assessment report that were deemed as needing improvement or incomplete. These included:

- a. Unorthodox and incomplete curricular maps
- b. Rubrics used for direct assessment that needed more details and information
- c. Failure to include data from the direct assessment of student assignments
- d. Missing closing the loop analysis

We will try to improve in each of these areas in this current assessment report. In spring 2020, we will have our External Review Team Visit for our Academic Program Review. We look forward to using this opportunity to improve our program assessment in preparation for the upcoming Academic Program Review.

Methods: Program Learning Outcome #4

PLO4: Critically review scientific papers and demonstrate communication skills appropriate for professional level employment in science and technology based business/research/industry.

As can be seen on the attached PLO to course curriculum map (Appendix D), 12 of the 13 required Biotechnology program courses map to PLO4. A reason for this is that PLO4 can be broken up into two separate parts:

- 'Critically review scientific papers'
- 'Demonstrate communication skills appropriate for professional level employment'

Our PSM in Biotechnology program curriculum is divided up with about 2/3 of the required classes being Biology lecture or lab science classes and about 1/3 of the required classes being Bioentrepreneurship (MBA business) classes. This class distribution between science and business classes was chosen largely based upon recommendations from the National Professional Science Master's Association (NPSMA) for all of their affiliated PSM programs.

'Critically review scientific papers' is a key aspect of almost all of the Biology lecture and lab classes that the students take including BTEC600, BTEC620, BTEC685/686, and BTEC688/689. We chose to evaluate a journal club presentation assignment from the BTEC688/689 class. For this assignment, the students use journal database searches to select a paper and then put together and deliver an oral class slide presentation.

'Demonstrate communication skills appropriate for professional level employment' is a key aspect of all of the Bioentrepreneurship and career-based classes including MBA6413, MBA6561, MBA6562, MBA6563, BIOL680 and BTEC601. We chose to evaluate a cover letter assignment from BTEC601 – students produce a mock cover letter for an application they would submit for an internship or job position. Additionally, we chose to evaluate a written report where the students analyzed the business aspects of speaker presentations that was a part of their BIOL680 Bioentrepreneurship AGI class.

For all three of these classes, assignments from each student were collected and then evaluated for how well they achieve PLO4. Student assignments were rated using a rubric on a 1-10 point scale, with scores of 4 or lower being weak, scores of 5-6 being satisfactory,

scores of 7-8 being good, and scores of 9-10 being excellent. Faculty raters also included written comments for each assignment rated. Because which part of PLO4 was being assessed for the three classes was different (reviewing scientific papers vs. professional communication) two separate rubrics were created for each – see Appendix A.

Between 11 and 16 assignments were rated for each course – these numbers of assignments were relatively low (results would be more meaningful with a larger sample size of 30+ student assignments). This will always be a limitation of our program analysis as typically all of our courses are small in size with 10-15 students each. A possible alternative in the future would be to collect assignments over multiple years.

Results: Program Learning Outcome #4

The BTEC688/689 journal club presentations were evaluated for achievement of PLO4 by determining whether students could critically evaluate the scientific literature. The mean score from the faculty rater for this class assignment was 7.5 (out of 10) with a standard deviation of 1.8 (see raw data in Appendix B). All of the assignments were judged to be at least ‘satisfactory’ and 8 of the 11 assignments were judged to be ‘good’ or ‘excellent’. Overall, students demonstrated a strong ability to critically evaluate the scientific literature.

A challenge that was noted while performing this assessment was that only the student-prepared slides were saved and available for evaluation. These student slides did provide useful information about how well the students were able to achieve PLO4. However, what would be useful in addition would be audio and/or video recordings of the student presentations and paper discussion. This would give the reviewer a much more complete understanding of the student’s understanding and ability to evaluate each scientific paper. Recording student presentations in the future for the purpose of assessment is something that we will consider doing.

For the BTEC601 cover letter assignment the mean rating was 7.6 with a standard deviation of 1.3. For the BIOL680 written report the mean rating was 8.1 with a standard deviation of 1.6. For each of these assignments, over 85% of the students were measured to be ‘good’ or ‘excellent’. Overall, students demonstrated strong success in demonstrating good professional communication skills.

Since direct assessment data was not included in the Biotechnology PSM program reports from previous years, we could not make meaningful comparisons between student achievement this year and in previous years.

Closing the Loop

It was challenging to do our assessment on PLO4 because so many classes in our program (12 of the 13) fulfilled PLO4 to some degree. In the future, it makes sense to split this program learning outcome into two parts – the first PLO evaluating the students’ ability to understand and present information from scientific papers (applicable to the Biology science

courses) and the second PLO evaluating the students' teamwork and business communication skills (applicable to the Bioentrepreneurship business courses).

We have reworded the old PLO5 to reflect more accurately the business interaction skills we are developing, and are specifically identifying the attendant assignments and rubrics in the bioentrepreneurship courses.

In our most recent Scientific Advisory Board meeting (5/11/18), our Advisory Board suggested a change to PLO2 – to not just 'perform best practices and biotechnology-related laboratory techniques' but also to be able to 'exhibit an ability to assess the novelty of research and prioritize protocols'.

Our conclusion therefore is that we should modify our PLOs:

- adding to PLO2
- splitting the current PLO4 into two separate PLOs – one which covers critical evaluation of scientific papers and the second which covers business communication skills and networking
- Change some of the wording used for the remaining PLOs, such as going from 'Interpret' to 'Review and evaluate' and from 'Articulate' to 'Comprehend'.

The old and proposed new versions of our Program Learning Outcomes:

Current Program Learning Outcomes:

1. Interpret concepts from multiple disciplines (biology, bioinformatics, business) within biotechnology.
2. Perform best practices and biotechnology-related laboratory techniques.
3. Articulate the need for ethics in science and technology based business/research/industry.
4. Critically review scientific papers and demonstrate communication skills appropriate for professional level employment in science and technology based business/research/industry.
5. Network with industry members in molecular biology and biotechnology based business/research/industry.

Proposed New Program Learning Outcomes:

1. Review and evaluate concepts from multiple disciplines (biology, bioinformatics, business) within biotechnology.
2. Interpret and execute best practices in biotech-related lab techniques as well as exhibit an ability to assess the novelty of research and prioritize protocols.
3. Comprehend the need for ethics in science and technology based business/research/industry.
4. Critically review scientific papers and demonstrate science communication skills necessary to attain professional level employment in science and technology based research/industry.

5. Demonstrate effective teamwork, team leadership, business communication skills, and networking skills, including exposure to industry members in molecular biology and biotechnology based business/research/industry.

After receiving the official feedback report from the Dean's office on this Yearly Assessment Report, we will hopefully send these proposed changes to the PLOs through the Dean's office and Curriculum committee for approval. With these PLO changes in place, future yearly assessment of student achievement of these PLOs should be cleaner and more meaningful.

Curriculum Maps

The Curriculum map aligning the Institutional Learning Outcomes (ILOs) with the Biotechnology Program Learning Outcomes (PLOs) is included in Appendix C.

The Curriculum map aligning required Biotechnology program courses with Biotechnology PLOs is included in Appendix D.

Appendix A: Biotechnology PSM PLO4 assessment rubrics:

Criteria	Ratings			
	Weak (1-4)	Satisfactory (5-6)	Good (7-8)	Excellent (9-10)
Demonstrated ability to critically review scientific papers	Unable to distinguish between review article and primary scientific literature. Presentation disorganized or lacking important information. Missing or incomplete connection to other scientific articles. Poor understanding or interpretation of data from article.	Primary scientific literature paper chosen. Presentation organized but lacking key information in areas. Makes some connection to other scientific articles. Satisfactory understanding and interpretation of data from article is demonstrated.	Primary scientific literature paper chosen. Presentation organized but lacking but missing minor pieces of information. Makes some connection to other scientific articles. Complete understanding and interpretation of data from article is demonstrated.	Primary scientific literature paper chosen. Presentation well organized throughout. Makes many connections to other scientific articles. Complete understanding and interpretation of data from article is demonstrated.

Total Points: _____ out of 10

Rater notes:

Criteria	Ratings			
	Weak (1-4)	Satisfactory (5-6)	Good (7-8)	Excellent (9-10)
Demonstrate communication skills appropriate for professional level employment	Unprofessional demonstration of business communication skills. Disorganized presentation. Ineffective arguments made. Multiple grammar and spelling errors found.	Professional business communication skills demonstrated, but with areas of improvement. Presentation organized but with some rearrangement suggested. Arguments made effectively. Three or less grammar and spelling errors found.	Professional business communication skills demonstrated – meeting expectations of working business professionals. Presentation organized but with some rearrangement suggested. Strong arguments made. No grammar and spelling errors found.	Professional business communication skills demonstrated to the highest degree – as would be done by experienced working professionals. Presentation organized with strong arguments made throughout. No grammar and spelling errors found.

Total Points: _____ out of 10

Rater notes:

Appendix B: Direct Assessment raw data:

BTEC601: Career Preparation Seminar

Student	Work assessed	Rating (1-10)	Comments
1	cover letter 1	9	well-written, highlights lack of wet lab experience
2	cover letter 2	7	include company info at top, highlight why well-qualified for this specific
3	cover letter 3	10	excellent organization/presentation
4	cover letter 4	7	"caught by your" unusual terminology, add more specifics about job
5	cover letter 5	7	highlight more specifics about this employer
6	cover letter 6	7	"your Halder lab", "for Gladstone Institute" awkward
7	cover letter 7	8	description of experience good, add more specifics about employer
8	cover letter 8	8	description of experience good, add more specifics about employer
9	cover letter 9	6	"sufficient amount" weak phrase, make more specific for this position
10	cover letter 10	7	more specific to this position/employer
11	cover letter 11	7	good mention of specific reference, "Master's course in the same" awkward
12	cover letter 12	8	name specific project manager company
13	cover letter 13	10	great matching of requirements and experience
14	cover letter 14	8	make verbiage stronger
15	cover letter 15	5	use last name as well, typos, grammar errors
16	cover letter 16	8	personal attributes section good
	mean rating	7.625	
	standard deviation	1.31021627	

BIOL680: Bioentrepreneurship Academic Global Immersion (AGI)

Student	Work assessed	Rating (1-10)	Comments
1	AGI BIEM 2.0 report	9	detailed, complete
2	AGI BIEM 2.0 report	4	outline format lacks content
3	AGI BIEM 2.0 report	9	detailed analysis of all aspects of BIEM 2.0
4	AGI BIEM 2.0 report	8	complete summary of all BIEM aspects
5	AGI BIEM 2.0 report	8	fairly complete - lack of bioethics analysis
6	AGI BIEM 2.0 report	10	table format excellent way of presenting
7	AGI BIEM 2.0 report	9	well written, organized
8	AGI BIEM 2.0 report	9	well written, organized
9	AGI BIEM 2.0 report	7	lack of content on several items
10	AGI BIEM 2.0 report	10	table formatting professional and clear
11	AGI BIEM 2.0 report	8	good content, small grammatical issues
12	AGI BIEM 2.0 report	8	good content, writing style issues
13	AGI BIEM 2.0 report	9	detailed, excellent presentation
14	AGI BIEM 2.0 report	6	outline format lacks some key content

mean rating 8.14285714
standard deviation 1.61040572

BTEC688/689: Advanced Research Methods

Student	Work assessed	Rating (1-10)	Comments
1	journal club presentation	7	paper background info good, slides cluttered complex
2	journal club presentation	5	slides heavily text based, background info sufficient
3	journal club presentation	6	discussing more recent related papers would be good addition
4	journal club presentation	10	excellent - clear understanding and presentation
5	journal club presentation	7	text heavy slides, clutter distracting
6	journal club presentation	10	excellent and clear
7	journal club presentation	6	needs more information about related papers to put into correct context
8	journal club presentation	10	excellent
9	journal club presentation	8	understanding of paper was good, communication ok
10	journal club presentation	7	background could be presented more clearly
11	journal club presentation	7	related papers discussion good, slide presentation somewhat cluttered

mean rating 7.54545455
standard deviation 1.75291964

Appendix C: Institutional Learning Outcomes vs. Program Learning Outcomes:

	PLO1	PLO2	PLO3	PLO4	PLO5
Institutional Learning Outcomes X Program Learning Outcomes	1. Synthesize concepts from multiple disciplines (biology, bioinformatics, business) within biotechnology	2. Perform best practices and biotechnology-related laboratory techniques	3. Demonstrate knowledge of the need for ethics in science and technology based business/research/industry	4. Critically review scientific papers and demonstrate communication skills appropriate for professional level employment in science and technology based business/research/industry	5. Network with biotechnology industry members and gain employment in science and technology based business/research/industry
Institutional Learning Outcomes					
1. Students reflect on and analyze their attitudes, beliefs, values, and assumptions about diverse communities and cultures and contribute to the common good.			X		
2. Students explain and apply disciplinary concepts, practices, and ethics of their chosen academic discipline in diverse communities.	X		X	X	
3. Students construct, interpret, analyze, and evaluate information and ideas derived from a multitude of sources.	X			X	
4. Students communicate effectively in written and oral forms to interact within their personal and professional communities.				X	X
5. Students use technology to access and communicate information in their personal and professional lives.		X			
6. Students use multiple methods of inquiry and research processes to answer questions and solve problems.	X	X			
7. Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world.			X	X	

