2022-2023 ASSESSMENT REPORT
PROFESSIONAL SCIENCE MASTER'S IN BIOTECHNOLOGY
GRADUATE PROGRAM

Program: **Master's in Biotechnology, PSM**
Degree type: **Graduate program**, College of Arts and Sciences
Assessment coordinator: Cary Lai, Program Director, cklai2@usfca.edu

Mission Statement

Mission Statement (no changes made since October 2018):

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

PSM in Biotechnology Program Learning Outcomes (no changes made since May 2019):

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.

Curricular Maps

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

The Curricular map aligning required Biotechnology program courses with Biotechnology PLOs is included in Appendix D. No changes have been made to the Curricular map since 2019.

Assessment schedule between APRs

2015-2016: Assessment of **PLO5**
2016-2017: Assessment of **PLO1**
2017-2018: Assessment of **PLO4**
2018-2019: Assessment of **PLO2**
2019: Rewriting and numbering of the PLOs took place.

2019-2020: Alternative assessment reflection on distance learning pivot (no specific PLO assessed)

2020-2021: Assessment of **PLO1**: *Review and evaluate concepts from multiple disciplines (biology, bioinformatics, business) within biotechnology.*

October 2021: Academic Program Review of our PSM in Biotechnology program took place

2021-2022: Assessment of **PLO3**: *Comprehend the need for ethics in science and technology based business/research/industry.*

Methods: Program Learning Outcome 5

This year, we chose to assess PLO5:

PLO5: ***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.***

We chose to assess PLO5 in part because it has been the longest period of time (since 2015-2016) since a version of this PLO has been assessed.

Our interpretation of PLO5 is that the ideal student work product would demonstrate mastery in **all** three areas of:

1. Effective teamwork and/or team leadership
2. Business communication skills
3. Networking exposure to biology/biotechnology industry members

We created a grading rubric included in Appendix A, whereby the student work products would only receive the highest score (out of 10) if they demonstrated mastery in all of the three areas listed above. Assignments would be graded intermediate scores if they demonstrated competency in one or two of the three areas listed above.

We chose to assess student work product from four very different courses in our Biotechnology program:

1. **BTEC 601: Career Preparation seminar.** A 1-credit course that students take in their first semester in the program which helps them with their job application skills – resume creation, mock interviews, etc. The assignment used was a job application cover letter that the students produced.
2. **BTEC 610: Global & U.S. Regulatory Affair.** A course in our Bioentrepreneurship curriculum. The assignment used was an analysis of a drug or medical device failure.
3. **BTEC 615: Bioinnovation Management.** A second course in our Bioentrepreneurship curriculum. The assignment used was a team report and presentation from a group of 4-5 students who worked to solve a puzzle collaboratively.
4. **BTEC 697: Internship in Biotechnology.** This capstone course where students work in industry and evaluate their experiences at biotechnology companies. The assignment used was a final summary progress report from their internships.

For all four of these classes, assignments from each student were collected and then evaluated by our assessment committee to determine how well they achieved PLO5. Student assignments from all four classes were rated using the same PLO5 assessment 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 (see Appendix A).

Results: Program Learning Outcome 5

The complete results of the PLO5 assessment are shown in Appendix B. In summary:

- The BTEC 601 assignment had a mean score of 6.5 (26 work products) with a standard deviation of 1.5
- The BTEC 610 assignment had a mean score of 6.8 (4 work products) with a standard deviation of 1.3
- The BTEC 615 assignment had a mean score of 7.5 (2 work products) with a standard deviation of 0.7
- The BTEC 697 assignment had a mean score of 6.8 (26 work products) with a standard deviation of 1.6.

Based on the rubric that was created for this assessment, we found that almost all of the students covered one of the key areas of PLO5, many covered two of the key areas, and a handful covered all three. One possibility to increase student performance in achieving higher scores on this PLO in future semesters is to require the students to cover multiple areas in their assignments in order to receive a maximal class grade for each of those assignments (the students were not asked to do so previously for these classes).

Program response and future improvement

Our assessment of PLO5 demonstrated that this PLO was written well and we felt that the scores of the student work products for this assessment rating were relatively high for each of the four classes that we utilized. One strength of PLO5 is that it covers a large percentage of courses in our BTEC program (8 of the 13 required courses) that include both science and bioentrepreneurship business classes. We plan to leave PLO5 as it currently is.

Feedback from previous year's assessment report

For the 2019-2020 academic year, we assessed PLO3: *Comprehend the need for ethics in science and technology based business/research/industry.* One of the suggestions that was made following this assessment was to increase the number of ethics-based assignments in our courses which would give us more student work products to review. We are still in the process of developing these new ethics-based assignments and adding them to our current BTEC courses.

Appendix A: Biotechnology PSM PLO5 assessment rubric:

PLO5: 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.

Criteria	**Ratings**			
	Weak (1-4)	**Satisfactory (5-6)**	**Good (7-8)**	**Excellent (9-10)**
PLO5: 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.	Student does not demonstrate successful accomplishment of any of the three listed areas.	Student clearly demonstrates a strong ability in **at least one** of the areas of 1. Teamwork/Leadership, 2. Business communication, or 3. Networking with industry members.	Student clearly demonstrates a strong ability in **at least two** of the areas of 1. Teamwork/Leadership, 2. Business communication, or 3. Networking with industry members.	Student clearly demonstrates a strong ability **in all three** of the areas of 1. Teamwork/Leadership, 2. Business communication, or 3. Networking with industry members.

Total Points: _____ out of 10

Rater notes:

Appendix B: Assessment raw data:

BTEC 601: Career Preparation Seminar

Student	Work assessed	Rating (1-10)	Comments
1	cover letter	7	Felix Biotechnology cover letter - more emphasis on previous teamwork/leadership would be a plus
2	cover letter	10	Amgen cover letter - good inclusion of business teamwork experience
3	cover letter	9	Gilead - good inclusion of communication and alumni chair role
4	cover letter	5	Melio - primarily technical
5	cover letter	7	Melio - good business communication emphasis
6	cover letter	5	Melio - primarily technical
7	cover letter	7	Abbvie - some communication emphasis
8	cover letter	8	Alector - clinical trial experience
9	cover letter	5	GeneEdit - primarily technical
10	cover letter	8	Atreca - communication and technical emphasis
11	cover letter	7	UCSF - technical with some communication
12	cover letter	6	UCSF - technical, brief mention of communication skills
13	cover letter	7	Acrobat - business communication and record keeping
14	cover letter	6	Nine Square - brief, with some communication mention
15	cover letter	5	Mission Barn - almost all technical
16	cover letter	8	MelioLabs - technical with good business communication
17	cover letter	7	Abbvie - good technical/some business
18	cover letter	7	Axent - technical with some business communication
19	cover letter	8	Nine Square - emphasis of leadership experience strong
20	cover letter	6	Felix - brief communication with technical
21	cover letter	6	Earli - business communication but only with generalities
22	cover letter	4	Felix - generic lacking specifics
23	cover letter	6	Melio - technical, but detailed and well-written
24	cover letter	4	Melio - lacking specifics
25	cover letter	5	Astellas - more communication/business would be beneficial
26	cover letter	6	Tempo - some communication skills discussed
	average rating	**6.5**	
	standard deviation	**1.47648231**	

BTEC 610: Global & US Regulatory Affairs

Student	Work assessed	Rating (1-10)	Comments
1	Drug and Device failure analysis	8	strong business communication and industry focus, not much emphasis on teamwork/leadership
2	Drug and Device failure analysis	5	science heavy/oriented - more business focus would help

3	Drug and Device failure analysis	7	good business communication and industry focus, not much emphasis on teamwork/leadership
4	Drug and Device failure analysis	7	strong industry focus, not much emphasis on teamwork/leadership
	average rating	**6.75**	
	standard deviation	**1.25830574**	

BTEC 615: Bioinnovation Management

Student	Work assessed	Rating (1-10)	Comments
1	Team reports and presentation	8	teamwork/leadership and business communication demonstrated; not biotechnology industry focused
2	Team reports and presentation	7	teamwork/leadership and business communication demonstrated; not biotechnology industry focused
	average rating	**7.5**	
	standard deviation	**0.70710678**	

BTEC 697: Internship in Biotechnology

Student	Work assessed	Rating (1-10)	Comments
1	Final Progress Report	6	Discussion of internship experience at Insitro only. Limited business discussion
2	Final Progress Report	4	Discussion of Business Development internship experience. Not much biology or bioinformatics involv
3	Final Progress Report	6	Internship experience at Ivy Natal focusing on lab techniques, troubleshooting, and working with autom
4	Final Progress Report	8	Discussion of clinical trial experience at Alto Neuroscience plus roles in data validation and business pr
5	Final Progress Report	9	Mixed discussion in lab skills, data validation, and weekly presentation.
6	Final Progress Report	6	Discussion of blood processing and worked as a team at IgGenix
7	Final Progress Report	9	Discussion of optimizing lab experiments, shifting priorities between projects
8	Final Progress Report	7	Two leanring goals at Alector, examined Protein X's role as an anti-tumor agent and optimization of an
9	Final Progress Report	9	Internship at Allogene Therapeutics provided a range of activity to improve analytical skills, communic
10	Final Progress Report	5	Good discussion in drug assay experiment. No business discussion
11	Final Progress Report	6	Discussion in mol bio and genetic engineering. Missing business discussion.
12	Final Progress Report	7	Mixed discussion in lab skills, experiments. No discussion in business
13	Final Progress Report	5	Biomarker dicussion only
14	Final Progress Report	6	Science focus, no business discussion.

15	Final Progress Report	9	Mixed discussion in lab skills, experiments, project management as well as communications.
16	Final Progress Report	6	Biology focus, bioinformatics and business discussion limited.
17	Final Progress Report	6	Science focus, no business discussion.
18	Final Progress Report	7	Biology and bioinformatics focus. Business discussion limited.
19	Final Progress Report	8	A combination of biology and business discussion. Bioinformatics discussion limited
20	Final Progress Report	6	Biology focus, bioinformatics and business discussion limited.
21	Final Progress Report	5	Business focus. Biology and bioinformatics discussion limited.
22	Final Progress Report	9	Mixed discussion in lab skills, experiments, project management as well as inventory management
23	Final Progress Report	6	Biology focus, bioinformatics and business discussion limited.
24	Final Progress Report	9	Discussion focus on EMT process, techniques and contract management
25	Final Progress Report	9	Discussion among lab experiments, project management, and data visualization at Alector .
26	Final Progress Report	5	No bioinformatics or business discussion

average rating	**6.84615385**
standard deviation	**1.59228911**

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

	PLO1	PLO2	PLO3	PLO4	PLO5
Institutional Learning Outcomes X 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.
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	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

Appendix D: Curricular Map – Courses vs. Program Learning Outcomes:

		PLO1	PLO2	PLO3	PLO4	PLO5
	Biotechnology course Curricular Map 2020-2021	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.
Semester	**Courses or Program Requirement**					
1	**BTEC601**: Career Preparation Seminar - seminar, 1 unit				I	I
1	**BTEC610**: Global and U.S. Regulatory Affairs - lecture, 2 units			D	D	D
1	**BTEC611**: Legal-Social-Ethical Biotech - lecture, 2 units			M	D	D
1	**BTEC620**: Molecular Biology - lecture, 4 units	I		I	I	
2	**BTEC612**: Local, National, Global Biotech - lecture, 2 units				D	I
2	**BTEC615**: Bioinnovation Management - lecture, 2 units				D	M
2	**BTEC619**: Bioentrepreneurship AGI - fieldwork, 2 units				D	M
2	**BTEC685/686**: Molecular Genetics and Biotechnology - lab, 4 units	D	I		D	
3	**BTEC688/689**: Advanced Research Methods - lab, 4 units		M		D	
3	**BTEC640**: Bioinformatics - lecture, 4 units	D	D			
4	**BTEC600**: Molecular Biology seminar - seminar, 1 unit				D	D
4	**BTEC697**: Internship in Biotechnology - fieldwork, 4 units		M		M	M
4	**BTEC elective**: lecture, 4 units	M			D	
		Key:				
		I = Introductory				
		D = Developing				
		M = Mastery				