

Student Learning Outcomes Assessment Plan
Master of Biotechnology Program
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Background:

The Master of Biotechnology (M.Bt.) Degree is an interdisciplinary graduate program housed in the Department of Biology in the College of Science and Mathematics, but integrated across Departments in several Colleges and Schools of the University.

The M.Bt. degree is a designated Professional Science Master's (PSM) degree, a relatively new inter-disciplinary degree concept (developing nationally since 1997) wherein students are fundamentally educated in the sciences, but also engage in so-called "plus" courses and an internship experience as part of the core curriculum, in order to promote rapid transition of students into business, industry, non-profit organization or government agency careers. As is common with most PSM degrees, the "plus" component of the M.Bt. degree emphasizes business courses and experiences.

Biotechnology includes an incredibly wide diversity of applications including, for example, pharmaceutical development, crop and livestock improvement, diagnostic and therapeutic medicine, industrial processing, and bioremediation of contaminated environments. The M.Bt. degree will encourage students with interests in many of these areas, but, due to unique regional resources, the program will emphasize the areas of: agricultural biotechnology, medical diagnostics, bioremediation, and biofuels development.

Mission:

Biotechnology is a multidisciplinary endeavor that increasingly requires employees fluent in both science and business to enable the development of new technologies and products based on the unique applications of the cellular and molecular life sciences. The Professional Science Master's Degree in Biotechnology at the California State University, Fresno offers students, who are fundamentally educated in various scientific disciplines, the opportunities to acquire the knowledge and skills required to comprehend and commercialize these emerging technologies and/or their products.

Learning Goals and Objectives for Biotechnology Graduate Students

Goal 1. To enhance depth of understanding of the current knowledge and skills of the cellular and molecular life sciences.

Objective 1.1 Graduate students will analyze current scientific literature that presents the concepts and technologies of molecular/cellular biology, in order to develop an integrated synthesis addressing a specific topic or issue

Objective 1.2 Graduate students will demonstrate a breadth of knowledge of information resources available for maintaining currency in biotechnology, including scientific journals, trade publications, scientific and commercial databases, and Internet resources.

Objective 1.3 Graduate students will demonstrate hands-on comprehension of scientific methodology and results analysis.

Goal 2. To develop facility with business practices and culture.

Objective 2.1 Graduate students should demonstrate comprehension of the broad aspects of business operations and organization.

Objective 2.2 Graduate students should demonstrate the ability to work collaboratively on projects involving typical business timelines.

Objective 2.3 Graduate students should demonstrate sound professional ethics, leadership and consensus building skills relevant to the scientific aspects of a business enterprise.

Goal 3. To develop effective oral and written communication skills in both scientific and business settings.

Objective 3.1 Graduate students should effectively disseminate technical information using written progress reports, strategic reports, formal scientific written communications, and/or operations and procedures manuals.

Objective 3.2 Graduate students should effectively organize oral presentation for either informal or formal settings.

Objective 3.3 Graduate students should effectively impart informal oral summaries and/or professional oral presentations.

Goal 4. To develop effectiveness as liaisons between scientific and management components within a biotechnology enterprise.

Objective 4.1 Graduate students should demonstrate depth of expertise in a coherent area of biotechnology.

Objective 4.2 Graduate students should demonstrate a comprehension of a breadth of biotechnology processes and applications.

Objective 4.3 Graduate students should demonstrate a comprehension of the process of biotechnology commercialization, not limited to scientific goals, but including attention to meeting financial and regulatory compliance issues and goals.

Assessment Tools for Conducting Student Learning Outcomes Activities

1. Graduate Writing Requirement Submission: Quantitative measures of the scores attained by program students on their first attempt to pass the Graduate Writing Requirement; scores for all components of the scoring rubric will be used for evaluation.
2. Internship Forum Event: A scoring rubric assessing the student oral presentations will be distributed to industrial representatives, faculty and student peers attending the event.
3. Internship Evaluation: A performance evaluation distributed to the internship supervisor following completion of the industrial experience with their company.
4. A scoring rubric assessing the culminating experience oral defense.
5. An Exit Interview with students on completion of the oral defense.
6. A formative survey of student performance distributed to the supervisor of the sponsoring business or and agency midway through the industrial experience.
7. A formative survey will be given to students following completion of the industrial experience—internship.
8. A scoring rubric assessing the culminating experience written component.
9. A summative survey given to the graduates two years after completion of the program.
10. A summative survey of industries and agencies employing graduates one year after employment.

Coordinating Assessment Tools with Student Learning Objectives

Individual assessment tools are utilized to focus on certain student learning goals and objectives. A “map” showing the coordination is presented in Table 1.

Table 1. Summary of Methods to Assess Program Goals and Objectives

Assessment Activity	Goal #1			Goal # 2			Goal #3			Goal # 4		
	a	b	c	a	b	c	a	b	c	a	b	c
Grad Writing Req.	X	X					X				X	
Internship Forum				X				X	X			X
Internship Evaluation			X	X	X	X	X	X	X			X
Culm. Exp. Oral			X	X				X	X	X	X	X
Exit Interview			X	X							X	X
I.E. Sponsor Survey			X	X	X	X					X	
I.E. Student Survey		X	X	X	X	X					X	X
Culm. Exp. Written	X	X	X	X			X				X	X
Summative Student	X	X	X	X	X	X	X	X	X		X	X
Employer Survey	X	X	X	X	X	X	X	X	X		X	X

Assessment of Selected Objectives

Initial assessment of biotechnology student learning outcomes will emphasize those goals and objectives addressing communication skills, i.e. the fundamental skill set mentioned as critical to student success by every business or industry partner responding during the feasibility study phase of the degree development. In addition certain goals and objectives focused on business facility will be integrated into the scoring rubrics associated with certain core course milestones or events, in order to assess “plus” elements which were also identified as being fundamental in importance for student success in business or agency careers. The following assessment measures represent only some of the possible means by which student learning outcomes can be assessed. Primary trait analysis will be a central focus of the initial formative assessment process.

I. Communication Skills:

Objective 1.1 Graduate students will analyze current scientific literature that presents the concepts and technologies of molecular/cellular biology, in order to develop an integrated synthesis addressing a specific topic or issue

Assessment Activity 1.1: Based on the Graduate Writing Requirement

Primary Trait: The graduate student has demonstrated the ability to “integrate and analyze” the current state of knowledge in a specific area of biotechnology in a written document.

Scoring Rubric:

1. *Beginning:* The manuscript contains numerous flaws in the essential components of a literature review. The manuscript lacks successful synthesis of disparate works, and there is no logical flow to the presentation. These issues result in a manuscript with limited comprehensibility and utility in illustrating the author’s effective grasp of the material.
2. *Developing:* Weakness is evident in the coverage of the field and analysis resulting in incorrect or poorly developed synthesis of results. Analysis is limited to categorizing and summarizing scientific topics. The resulting manuscript significantly degrades the comprehensibility of the document and the identification of knowledge gaps.
3. *Satisfactory:* Identification of key topics or uncertainties in the field may be incomplete. New concepts resulting from a synthetic presentation of ideas is poorly developed or lacking. Complex topics and related concepts are awkwardly presented and linkages among topics may be unclear.
4. *Accomplished:* There may be inconsistencies in the organization and logic of the presentation, but still clear analysis of presented materials. While synthesis of all aspects of the topic may show varying degrees of development, the overall consistency, thoroughness, and analysis result in a well-crafted document.
5. *Exemplary:* The document presents the current state of knowledge for the topic being addressed utilizing a diversity of scientific opinions. These various, and possibly conflicting, opinions are presented in a balanced manner and seamlessly woven together to illustrate a complete grasp of the scientific literature across multiple research approaches utilizing appropriate national and international peer-reviewed resources. Essential findings of multiple sources are accurately and concisely paraphrased, analyzed, and integrated. Original sources are clearly identified and correctly cited in both the body of the text and the reference section. Organizationally smooth and effective transitions between topics lead the reader through an orderly discussion of the topic being addressed. The gaps in current knowledge are clearly identified and significant directions for future work are included.

Objective 3.2 Graduate students should effectively organize and impart informal oral summaries and/or professional oral presentations.

Assessment Activity 3.2: Based on the oral presentation of the Internship Experience

Primary Trait: The graduate student should organize an oral presentation wherein the mission and general operations of the internship company/agency are introduced, so that the role assigned to the intern within this enterprise is clearly communicated

Scoring Rubric:

1. *Inadequate:* The presentation did not provide sufficient information about the company/agency to understand the role that the intern played during the industrial experience.
2. *Adequate:* The presentation contains information about the mission and operations of company/agency, and it identifies the role of the intern, but with limited utility for “first time listeners”.
3. *Good:* The presentation introduces sufficient information on the company/agency to understand where the intern’s role fits into the company structure
4. *Excellent:* The presentation provides a thorough introduction to the company/agency so that the contributions the intern’s role provides this enterprise is clearly evident.

Objective 3.3 Graduate students should effectively impart informal oral summaries and/or professional oral presentations.

Assessment Activity 3.3: Based on the oral presentation at the Internship Forum Event

Primary Trait: The graduate student should deliver an oral presentation in a clear, articulate and comfortable manner.

Scoring Rubric:

1. *Inadequate:* The presentation was poor in clarity and articulation and the student appeared anxious.
2. *Adequate:* The presentation was clear and articulate some of the time and the student appeared somewhat relaxed.
3. *Good:* The presentation was clear and articulate most of the time and the student appeared comfortable and relaxed most of the time.
4. *Excellent:* The presentation was very clear and well-articulated with the student exhibiting composure and a relaxed attitude.

II Business Skills:

Objective 2.1 Graduate students should demonstrate comprehension of the broad aspects of business operations and organization.

Assessment Activity 2.1: Based on Internship Supervisor Evaluation of Industrial Experience

Primary Trait: The graduate student should demonstrate a general knowledge of the organization and operations of the company/agency for which s/he served for the internship experience

Scoring Rubric:

1. *Poor:* The student seemed unable to understand the mission of the company/agency and performed duties in a rote fashion.
2. *Inadequate:* The student seemed to have a general grasp of the mission of the company/agency, but only vaguely understood why the work s/he conducted was important to the operations
3. *Fair:* The student understood the role played for the immediate project, but seemed less adept at relating it to the broader company/agency objectives.
4. *Good:* The student had a good grasp of the operations involved in the immediate project and could relate his/her role and project to the mission of the overall company.
5. *Very Good:* The student could clearly articulate why the project on which s/he served was important both to the immediate project and the overall mission of the company/agency and was able to recognize how new approaches might improve opportunities to achieve those objectives.

Objective 2.2 Graduate students should demonstrate the ability to work collaboratively on projects involving typical business timelines.

Assessment Activity 2.2: Based on Internship Supervisor evaluation of industrial experience

Primary Trait: The graduate student effectively managed timeliness and deadlines.

Scoring Rubric:

1. *Poor:* The student was frequently late and seemed unable to meet expected deadlines.

2. *Inadequate*: The student arrived on time and met deadlines when prompted.
3. *Fair*: The student was punctual and was aware of deadlines, meeting them most of the time.
4. *Good*: The student was dependable on timeliness, both in arriving to work and in meeting deadlines.
5. *Very Good*: The student was dependable in timeliness and meeting deadlines and could contribute means for meeting of the deadlines earlier.