

Student Learning Outcomes Assessment Plan (SOAP)

Department of Biology Graduate Program
California State University, Fresno
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Background:

The Department of Biology offers graduate training with the opportunity to specialize in several areas of advanced biological study. One graduate degree is offered, the Master of Science in Biology. The department also offers a Master of Biotechnology degree and via the Moss Landing Marine Laboratories a Master of Marine Science Degree. Neither are addressed in this SOAP. The M.S. in Biology degree requires a formal thesis following the completion of a field- and/or laboratory-based research project.

Three major emphases of the Department's graduate program are 1) to provide training for those wishing to enter Master's level careers in the biological sciences, 2) to prepare graduate students for teaching biological sciences in the primary and secondary schools, and junior college ranks and, 3) to provide a foundation for students seeking more advanced training at universities offering doctorate or professional degrees.

Mission Statement:

The graduate program of the Department of Biology will provide state-of-the-art educational experiences that will prepare students to make valuable contributions to society where a knowledge and understanding of biological organisms and processes are required (e.g., biodiversity, conservation and the environment, health sciences, and biotechnology). Students will learn laboratory and/or field techniques and will conduct independent research within the biological sciences. They will also acquire the skills necessary for communicating biological information to professional scientific peers as well as to the lay public.

Learning Goals and Objectives for Biology Graduate Students:

GOAL 1. To enhance the student's depth of understanding of selected topics in the biological sciences.

Objective 1.1 Graduate students will acquire content knowledge in specific areas in order to synthesize primary literature for thesis research.

Objective 1.2 Graduate students will broaden their knowledge in disciplines that are related to, or supportive of, thesis research.

GOAL 2. To cultivate skills for acquiring knowledge in the life sciences, both for matriculation and life-long learning.

Objective 2.1 Graduate students will demonstrate an ability to learn and conduct research, both independently and collaboratively.

GOAL 3. To increase the student's understanding of experimentation, observation and data analysis, and their application to defined questions in biology.

Objective 3.1 Graduate students will apply the scientific method and hypothesis testing for the design and implementation of a formal thesis research project.

Objective 3.2 Graduate students will analyze experimental or observational results by the application of quantitative methods where appropriate.

GOAL 4. To develop an awareness of available tools and fiscal limitations of conducting specific scientific endeavors.

Objective 4.1 Graduate students will demonstrate grantsmanship and writing skills for acquiring internal and/or external funds for conducting graduate research.

GOAL 5. To enhance communication skills, both written and oral, for purposes of conveying biological information to both professional scientists and the lay public.

Objective 5.1 Graduate students will present scientific content in the form of graduate seminars, lectures, and talks at professional scientific meetings at a level commensurate with standards of academic discourse.

Objective 5.2 Graduate students will organize and write the results of original research consistent with standards in primary, peer reviewed biological literature.

Objective 5.3 Graduate students will cultivate skills for formal job seminars and interviews.

Assessment of Selected Objectives

Initial assessment of graduate student learning outcomes in the Department of Biology will include quantitative measures of success in meeting specific objectives under Goals 3, 4, and 5. These objectives are associated with application of scientific method and experimental design, quantitative analysis techniques, grantsmanship, writing ability, seminar presentation and participation, and the quality of the final Master's Thesis. In particular, these objectives were chosen on the basis of specific numerical measures (outlined below) that can be applied to assess the Department's success in meeting the objectives. The following assessment measures represent some of the possible means by which the Department can assess graduate student outcomes.

1. Assessment of the Master's Thesis:

Primary Trait Analysis of the Master's Thesis will be one focus of the assessment plan for the graduate program in the Department of Biology. This assessment will be conducted formatively during the development of the thesis, and summatively at the end of the academic program.

Assessments will be carried out by the graduate student's Thesis Committee early in the writing process (formative assessment), as well as through the Best Thesis Award Committee appointed by the Biology Department Chair (summative assessment). Assessment techniques used by the Committee will provide an additional objective measure with which to judge thesis quality.

Assessment will be based on scoring rubrics to measure the quality of specific primary traits of the thesis (i.e., learning objectives). Committee members will score each of the Department's theses for five primary traits that represent specific learning objectives (outlined below). The sum of these scores across all theses will represent the assessment score for each faculty committee member. The average assessment score for each primary trait across all committee members will be the Departmental assessment score for that primary trait. The scoring of individual theses during assessment will also constitute an objective means for selecting the student to receive the "Best Thesis Award" in the Department.

Objective 3.1 Graduate students will apply the scientific method and hypothesis testing for the design and implementation of a formal research project.

Assessment Activity 3.1:

Primary trait: The Graduate student has clearly stated his/her research hypothesis/objectives in the thesis.

Scoring rubric:

- 1) Hypothesis/objectives not discernible from the text, or so confused so as to violate scientific principles.
- 2) Hypothesis/objectives discernible, but not stated in testable form; contextual connections vague.
- 3) Hypothesis/objectives recognized and well stated; contextual connections clear.
- 4) Hypothesis/objectives clearly stated and well crafted in an elegantly testable form; Hypothesis/objectives made with very clear contextual connection.

Objective 3.2 Graduate students will analyze experimental or observational results by the application of quantitative methods where appropriate.

Assessment Activity 3.2:

Primary trait: The quantitative analysis techniques applied to the experimental results are rigorous and appropriate for the results being analyzed.

Scoring rubric:

- 1) Quantitative methods do not describe the results, do not indicate levels of confidence in the experimental results, and/or are inappropriate for the data being analyzed (i.e., some assumptions of the technique are violated).

- 2) Quantitative methods describe the results, but do not appropriately indicate levels of confidence, or are inappropriate for the data being analyzed.
- 3) Quantitative methods clearly describe the results, appropriately indicate levels of confidence in the results, and are appropriate for the data being analyzed.
- 4) Quantitative methods are elegantly used to clearly describe results and to indicate levels of confidence. Methods used are appropriate for the data being analyzed, and no assumptions of the quantitative methods are violated.

Objective 5.2 Graduate students will organize and write the results of original research consistent with standards in primary, peer reviewed biological literature.

Assessment Activity 5.2a:

Primary trait: The thesis Introduction provides a historical context and literature review of the thesis topic

Scoring rubric:

- 1) The thesis introduction does not adequately review the historical literature and/or does not introduce the specific research problem by contextual framework.
- 2) The thesis introduction adequately reviews the historical literature but does not introduce the specific research problem in a contextual framework.
- 3) The thesis introduction is well written with adequate review of the historical literature. The specific research problem is placed in a contextual framework of previous work.
- 4) The thesis introduction is very well written and provides a nearly exhaustive review the historical literature. The specific research problem is clearly and elegantly presented in the context of previous work and represents a logical extension of the research problem.

Assessment Activity 5.2b:

Primary trait: The thesis Materials and Methods section are complete and clearly stated

Scoring rubric:

- 1) Procedures are vague, disorganized, and/or are filled with irrelevant information.
- 2) Procedures are unclear but interpretable. Some irrelevant information interferes.
- 3) Procedures are easily interpreted. Relevant information dominates.
- 4) Procedures are so clear that they require no additional interpretation and could be used directly as protocol. Appropriate details are provided.

Assessment Activity 5.2c:

Primary trait: The thesis Discussion section clearly integrates current results with previous scientific knowledge.

Scoring rubric:

- 1) The thesis Discussion merely a restatement of the results and is devoid of comparison to previously published findings.
- 2) The thesis Discussion weakly integrates current results with previous findings.
- 3) The thesis Discussion integrates current results with previous findings. Results are compared to conceptual framework of previously published research, but lacks sufficient detail.
- 4) The thesis Discussion clearly integrates current results with findings of previous research. Results are compared in a well constructed and detailed conceptual framework of previously published research.

2. Assessment of Graduate Student Performance in the Thesis exit colloquium:

All students in the program are required to deliver an exit colloquium when their research and analysis is completed. As in assessment of the written thesis, a similar conversion of primary trait scores by individual faculty members into departmental assessment scores for learning objectives will be implemented.

Objective 5.1 Graduate students will present scientific content in the form of graduate seminars, lectures, and talks at professional scientific meetings at a level commensurate with standards of academic discourse.

Assessment Activity 5.1a:

Primary trait: Organization of the Thesis exit seminar.

Scoring rubric:

- 1) The graduate seminar presentation was poorly organized such that topics were hard to follow.
- 2) The graduate seminar presentation was well organized, although at times, topics did not flow smoothly from one to another
- 3) The graduate seminar presentation was well organized, and topics flowed smoothly from one to another.
- 4) The graduate seminar presentation was extremely well organized and well rehearsed. All topics flowed smoothly from one to another, allowing the audience to effortlessly understand the content of the presentation.

Assessment Activity 5.1b:

Primary trait: Inclusion of relevant introductory and background content in the graduate (or Thesis defense) seminar.

Scoring rubric:

- 1) The graduate seminar presentation did not introduce the seminar topic with sufficient background information.
- 2) The graduate seminar presentation contained some introductory information, but did not adequately introduce the topic for those who did not have prior experience with the topic.
- 3) The graduate seminar presentation contained sufficient background for most of the audience to adequately follow the topic.
- 4) The graduate seminar presentation provided a thorough introduction to the topic, so that all attendees could clearly follow the subject matter.

Assessment Activity 5.1c:

Primary trait: Visual appeal of the graduate (or Thesis defense) seminar.

Scoring rubric:

- 1) The graduate seminar presentation lacked visual media to enhance retention of materials.
- 2) The graduate seminar presentation included some visual media to enhance retention of materials.
- 3) The graduate seminar presentation included visual media that were tastefully used to enhance retention of materials.
- 4) The graduate seminar presentation was tastefully and richly illustrated with visual media of several different formats.

3. Assessment of Graduate Student writing ability and grantsmanship:

Assessment of proposal writing and funding success is a clearly definable measure of how well the Department is preparing graduate students for “real world” fiscal limitations on research, and the expectations of potential employers. All students in the department have to develop and submit a research proposal for initially assessment of graduate level writing ability (the graduate writing requirement as mandated by the Division of Graduate Studies) and then to accompany their Advancement to Candidacy petition to the department. These proposals will be evaluated according to a scoring rubric (available on request) that assesses the following two objectives:

Objective 3.1 Graduate students will apply the scientific method and hypothesis testing for the **design** and implementation of a formal thesis research project.

Objective 4.1 Graduate students will demonstrate grantsmanship skills for acquiring internal and/or external funds for conducting graduate research.

4. Alumni Survey:

A survey of graduate students will be conducted every five years from the pool of students who graduated six months or more before the survey, and not including respondents from previous surveys. The survey will be used to describe and quantify the initial positions held by CSUF graduates following completion of their degree and their satisfaction with the curriculum and training they received, and will be used as the basis for a database on where Biology Graduate students find employment. Perhaps more importantly, however, the survey will provide feedback on the extent to which the CSUF Biology graduate program prepared them for their position. The survey is as follows:

**A Survey for recipients of the Master of Science in Biology of the Department of Biology,
California State University, Fresno.**

1. Last Name, First Name (Optional- your name will only be used to track respondents of the survey and limit additional contacts from our staff. All of your responses will be maintained in the highest confidence and will only be used for program assessment)

2. Year of Graduation _____

3. Are you currently employed in a field related to your M.S. Biology Degree?

- yes
- no

4. Are you currently continuing your education in a field related to your M.S. Biology degree?

- yes
- no

5. If yes to either or both of the above, please specify and check **all** that apply regarding current occupation:

- Academic graduate program (e.g. an additional M.A. or M.S., Ph.D. or D.Sc.)
- Health professional program (M.D., D.V.M., etc)
- Education professional program (e.g. Ed.D.)
- Education (e.g. secondary school teacher, community college instructor, professor)
- non-teaching research
- State or Federal agency employee
- Non-governmental organization or non-profit organization
- Industry (e.g., pharmaceuticals, biotechnology, agriculture, environmental)
- Legal or policy field
- Self employment
- other

6. How related is your current occupation to your M.S. Biology degree

- highly
- moderately
- somewhat
- not at all
- not employed

7. Please describe your current position

8. The M.S. biology degree provided me with in-depth training in a specific field of biology.

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree

9. The M.S. biology degree provided me with a working knowledge of biological laboratory and/or field research skills and technologies.

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree

10. The M.S. biology degree provided me with the ability to design and implement biological research, and analyze the results.

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree

11. The M.S. biology degree provided me with the ability to present the results of my research (e.g. orally, non-oral presentation, publication)

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree

12. The M.S. biology major prepared me well for entry into graduate or professional school.

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree
- Not Applicable

13. The M.S. biology major prepared me for employment in biology or another scientific field.

- Strongly Agree
- Agree
- No Opinion
- Disagree
- Strongly Disagree
- Not applicable

14. Adequate resources were available to allow me to complete research and other degree requirements in a timely fashion

- Strongly Agree
- Agree
- No Opinion
- Disagree

- Strongly Disagree
 - Not applicable
15. The number and variety of courses available for the M.S. biology major were adequate.
- Strongly Agree
 - Agree
 - No Opinion
 - Disagree
 - Strongly Disagree
16. The content of graduate courses offered was current and comprehensive.
- Strongly Agree
 - Agree
 - No Opinion
 - Disagree
 - Strongly Disagree
17. The biology faculty was enthusiastic about teaching.
- Strongly Agree
 - Agree
 - No Opinion
 - Disagree
 - Strongly Disagree
18. The biology faculty was enthusiastic about research
- Strongly Agree
 - Agree
 - No Opinion
 - Disagree
 - Strongly Disagree
19. My advisor provided excellent guidance and mentoring
- Strongly Agree
 - Agree
 - No Opinion
 - Disagree
 - Strongly Disagree
20. For those questions where your response was "strongly disagree" we would appreciate your explanatory comments.
25. Please describe your most memorable positive experience during your education in the CSU Fresno M.S. Biology program.

5. Interviews with graduating M.S. candidates:

This assessment activity aims to gauge graduate student satisfaction with the Biology M.S. program. Of the questions to be asked, four invite quantifiable results on a 1-5 scale, with 5 being superior. These four questions are:

1. Were adequate resources available to allow you to complete your research and other degree requirements in a timely fashion?
2. Did the curriculum meet your needs?
3. Were you satisfied with the guidance and mentoring of your advisor?

4. Were you satisfied with your degree of exposure to biological research and knowledge (e.g. via on-campus seminars, attendance at meetings, visits to other labs, etc.)?

Narrative responses will also be allowed in addition to the numerical responses.

The remaining three questions to be asked invite narrative responses and are:

5. What were the single best and worst events during the course of your degree?

6. What were the most important skills and/or elements of knowledge that you gained during your research [what did you learn]?

7. What are your career goals now that your degree is completed?

6. Evaluations of posters presented at scientific meetings:

The department has developed an evaluation sheet for assessing the quality and content of posters prepared by graduate students for presentation of research at scientific meetings. This assessment activity specifically addresses the following learning objectives:

Objective 5.1 Graduate students will present scientific content in the form of graduate seminars, lectures, presentations and talks at professional scientific meetings at a level commensurate with standards of academic discourse.

Objective 5.2 Graduate students will organize and write the results of original research consistent with standards in primary, peer reviewed biological literature.

Assessment activity: The grading sheet is as follows:

| Comments | Score | Description |
|---|----------|---|
| A. Hypotheses or problem statement | | |
| | 4 | Problem, question, or hypothesis is clearly stated and significance is clear |
| | 3 | Problem, question, or hypothesis is clearly stated, but scientific significance is unclear |
| | 2 | Lack of clarity in problem, question, or hypothesis, no significance evident |
| | 1 | No problem, question or hypothesis stated |
| B. Experimental design | | |
| | 4 | Experimental design directly tests hypotheses or addresses stated problem or question. Controls and replicates included, as well as statistical tests where appropriate. |
| | 3 | Experimental design directly tests hypotheses or addresses stated problem or question. Inadequate controls and replicates included, inadequate or incorrect statistical tests applied |
| | 2 | Experimental design only indirectly tests hypotheses or addresses stated problem or question. Inadequate controls and replicates included, no statistical tests applied |

| | | |
|-------------------|----------|---|
| | 1 | No evidence of the design addressing the stated question, problem or hypothesis |
| C. Results | | |
| | 4 | All aspects of design flawlessly executed |
| | 3 | Minor errors occurred in execution of design |
| | 2 | Major flaws evident in execution of experimental design |
| | 1 | Complete failure of the stated study to produce any results |

| | | |
|----------------------------------|----------|---|
| D. Discussion/conclusions | | |
| | 4 | Discussion/conclusions directly address the results, and are well supported by the evidence. Any limitations are acknowledged |
| | 3 | Minor flaws in the logic and applicability of the discussion and conclusions |
| | 2 | Major flaws in the logic and applicability of the discussion and conclusions |
| | 1 | No structure or relevance to the discussion or conclusions at all |
| E. Aesthetics | | |
| | 4 | Poster is eye-catching, attractively designed and professional in appearance. Font is large enough to be read at a distance of a meter |
| | 3 | Poster is attractively designed and professional in appearance, but lacks visual impact. Font is large enough to be read at a distance of a meter |
| | 2 | Minor flaws in design, layout or assembly detract from the poster |
| | 1 | The poster has major flaws in design, layout and assembly |

Implementation of the Assessment Pan:

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|--|---------------|---------------|---------------|---------------|---------------|
| Thesis | 5.2a-c | 5.2a-c | 5.2a-c | 5.2a-c | 5.2a-c |
| Thesis | 3.1, 3.2 | 3.1, 3.2 | 3.1, 3.2 | 3.1, 3.2 | 3.1, 3.2 |
| Thesis exit seminar | 5.1a-c | 5.1a-c | 5.1a-c | 5.1a-c | 5.1a-c |
| Grantsmanship and writing ability | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| Alumni Survey | | | | | x |
| Exit interviews | x | x | x | x | x |
| Poster evaluations | | 5.1, 5.2 | | 5.1, 5.2 | |

(numbers in each column correspond to specific assessment activities)