

**ASSESSMENT UPDATE – PROFESSIONAL SCIENCE MASTERS IN BIOTECHNOLOGY
GRADUATE PROGRAM
2015-2016 ASSESSMENT REPORT**

1. Mission Statement (provided to all students in the program in the student handbook):
The core mission of the Professional Science Master's (PSM) of Biotechnology at the University of San Francisco (USF) is to provide foundational knowledge in area of molecular biology and biotechnology, hands-on experience in the areas of bioinformatics and biotechnology related research methods, and a deep understanding of the business of biotechnology at the local, national and global levels so that students will have the knowledge and skills needed to successfully enter a career or advance their career in the biotechnology industry.

2. Program Goals:

Upon graduation, students who complete the PSM in Biotechnology degree requirements should be able to meet the following program goals:

- 1) *Understand the theory and fundamentals of molecular biology*
- 2) *Master key biotechnology laboratory skills*
- 3) *Develop a comprehension of the biotech business industry*
- 4) *Understand ethical practices in the biotechnology field*
- 5) *Demonstrate real-world application of skills and concepts in the biotech industry*

3. Program Learning Outcomes and Assessment:

- 1) Describe, synthesize and apply concepts & techniques in the current literature within a specific research area.
- 2) Give an oral presentation on current biotechnology research.
- 3) Critically discuss and write summaries of primary research.
- 4) Perform key molecular biology laboratory techniques (such as PCR, gel electrophoresis, DNA isolation, RT-PCR, CRISPR).
- 5) Analyze DNA, RNA, & Protein sequences using computer software (such as BLAST, DnaSP, EMBOSS, RNA-Seq).
- 6) Understand and demonstrate lab safety procedures.
- 7) Maintain a lab notebook; describe correct SOPs and other documentation required in a biotech lab. Design a research plan; obtain and critically analyze data, and effectively troubleshoot.
- 8) Discuss the biotechnology industry and how trends enable innovation.
- 9) Recognize global and local biotech leaders.
- 10) Employ effective managerial and leadership skills.
- 11) Describe the importance of applying ethical approaches to molecular biology applications.
- 12) Develop a results-oriented resume highlighting skills relevant to biotechnology positions.
- 13) Demonstrate effective interviewing skills to obtain employment in the biotech industry.
- 14) Understand and apply techniques to conduct a self-directed job search.
- 15) Apply knowledge and skills to day-to-day biotech industry operations.

4. Assessment:

Two molecular biology/biotechnology focused courses in the program were used in this assessment. Our rationale was that these are the 2 lab-based courses in the program that all students must take in order to graduate.

Fall 2015 BTEC 688/689 Advanced Research Methods (lecture/lab):

Background: This course is taken (typically) in a student's second year, prior to the start of their capstone internship (which occurs in the spring semester of their second year). Students examine the literature to develop their own novel scientific project. They design experiments, collect data and present their findings over the course of the semester. Specific techniques mastered depend on each individual student's research project, though all involve some subset of basic molecular biology techniques (e.g. PCR, DNA and RNA isolation) as well as cell culture and aseptic techniques.

Assessment:

- Written project proposal grant: With this assignment, students develop out their own novel research project after viewing the scientific literature. They must come up with their own experimental design to test their hypothesis. Students will carry out specific experiments (including PCR, quantitative PCR, western blot and tissue culture) to acquire data to either support and refute their hypothesis.
 - ❖ Example of project proposal instructions in "Supplementary Materials" folder.
- Two group meeting oral slide presentations
 - ❖ Example of group meeting instructions provided in "Supplementary Materials" folder.
- Journal club oral presentation
 - ❖ Example of journal club instructions provided in "Supplementary Materials" folder.
- Final written lab report: Details of molecular biology and cell biology techniques carried out are described in the final lab report. Collected data and accompanying analysis of the data is included in the final written lab report.
 - ❖ Example of final written lab report instructions provided in "Supplementary Materials" folder.
- Regular checks of student lab notebooks
 - ❖ Example of feedback from student lab notebook check provided in "Supplementary Materials" folder.
- Midterm and final exam
 - ❖ Example of BTEC 688 provided in "Supplementary Materials" folder.
- Each student read and provided a peer evaluation of another student's draft project proposal grant. The course TA, Alex Vecchio, did most of the grading of the journal club presentations.

- Techniques performed varied for each lab group based upon the particular project that they chose to carry out.

Spring 2016 - BTEC 685/686 Molecular Genetics and Biotechnology (lecture/lab):

Background: This course covers both the theoretical and practical experimental techniques including: (1) recombinant DNA techniques and methods of nucleic acid isolation and characterization (2) mammalian tissue culture cell techniques and cell line creation and (3) Cell line characterization using techniques such as qPCR, immunoblotting, flow cytometry, and microscopy. Lectures are integrated into the laboratory sessions and cover the biological basis and rationale of the experimental techniques utilized.

Assessment:

- Midterm exam and final exam: tested students ability to understand biological mechanisms of experiments performed, design experiments, do laboratory calculations, understand related scientific papers covered during the semester.
 - ❖ Examples of midterm and final provided in "Supplementary Materials" folder.
- Lab notebook: graded based on organization, completeness, following guidelines, etc.
 - ❖ Example of notebook check in "Supplementary Materials" folder.
- Group meeting presentation: powerpoint slide presentation given to the class summarizing experiments performed and results found.
 - ❖ Example of group meeting assessment in "Supplementary Materials" folder.
- Feedback and grading from course professors.
- List of techniques performed:
 - CRISPR
 - DNA molecular cloning (restriction digests, gel electrophoresis, gel extraction, DNA miniprep, DNA ligations, DNA transformation, PCR, DNA sequencing)
 - Tissue cell culture (splitting cells, cell transfection, freezing cell lines)
 - SDS-PAGE, western blotting
 - qPCR
 - flow cytometry
 - confocal microscopy