

Annual Assessment Report

MS in Chemistry

AY 24-25

Program Information:

Name of Program: MS in Chemistry

Degree Type: Graduate

Coordinating Faculty: Michael Stevenson (mstevenson3@usfca.edu)

Curriculum changes: The MS in Chemistry underwent a revamp over academic year 2024-2025. This was approved by the curriculum committee, Dean's office, and registrar. For the purpose of this assessment, the mission statement, program learning outcomes, and curricular map were changed.

Mission Statement: *(Contains changes which were approved by the Curriculum Committee)*

To deliver a broad-based, rigorous research-based training experience that prepares graduates for careers as PhD researchers, health professionals, government and industry professionals, and educators. With hands-on training and effective mentoring, students will be empowered with knowledge and skills necessary to conduct independent research while being ethical and socially responsible in the chemical research community. Students will generate new knowledge in the field by writing and publishing their novel research as a master's thesis.

Program Learning Outcomes: *(Contains changes which were approved by the Curriculum Committee)*

Students will:

1. demonstrate and develop knowledge of the primary sub-discipline of chemistry relevant to their research.
2. become safe and proficient in laboratory practice and instrumental techniques relevant to their research area.
3. communicate the subject of chemistry, especially their own research project, in written and oral forms.
4. apply the scientific method to address research questions by testing hypotheses, collecting data, interpreting the results, and generating new knowledge in the field.

Curricular Map: (Contains changes)

Course/ Requirement	Course Learning Outcomes	1. Students will demonstrate and develop knowledge of the primary sub-discipline of chemistry relevant to their research.	2. Students will become safe and proficient in laboratory practice and instrumental techniques relevant to their research area.	3. Students will communicate the subject of chemistry, especially their own research project, in written and oral forms.	4. Students will apply the scientific method to address research questions by testing hypotheses, collecting data, interpreting the results, and generating new knowledge in the field.
Evaluative Examinations	Students will either pass an American Chemical Society entrance exam in the 60th percentile or above or take an independent study course.	M			
CHEM 686	Students will critically read and evaluate primary scientific literature across multiple sub-disciplines of chemistry and extract key information. Students will develop skills to communicate effectively with chemists inside and outside of the student's specific area of focus.	D		D	
CHEM 690	Students will acquire and analyze research data using experimental, computational, and/or instrumental methods. Students will read, understand, discuss, and apply literature pertaining to the research project. Students will exercise safe and proficient laboratory practices and instrumental techniques.	M	M		M
CHEM 698	Students will organize and present valid scientific research in oral and poster format on their graduate research project. Students will critically evaluate scientific presentations both within and outside of their field of research. Students will develop a professional portfolio for applying for employment including cover letter, CV, and interview skills.	D		M	
CHEM 699	Students will prepare an organized manuscript that professionally presents the context, results, conclusions, and impact of independent scientific research. Students will demonstrate knowledge in the field of study through accurate communication of historical understanding, contemporary perspectives, and recent advancements in the field.			M	M
2nd Year Presentation	Students will present their research to the entire department in their fourth semester.			M	M

Key: I = Introductory; D = Developing; M = Mastery

Assessment Schedule:

F25 – PLO 4 (current)

F26 – PLO 1

F27 – PLO 2

F28 – PLO 3

Program Assessment:

Assessment Methodology:

For AY 24-25, we chose to evaluate PLO 4, which states that students will apply the scientific method to address their research questions by testing hypotheses, collecting data, interpreting results, and generating new knowledge in the field. For this assessment, we decided to assess the students' second year seminar which takes place at the end of their last semester. Each presenter followed the guidelines of an American Chemical Society (ACS) National Conference presentation of 18-20 minutes followed by questions and answers. Two students presented on April 24, 2025 and two students presented on May 1, 2025. Assessment was performed using the attached 10-question rubric which used a scale of 1 to 4 (where, 1 = disagree, 2 = somewhat disagree, 3 = somewhat agree, 4 = agree). At each presentation, 5-6 chemistry

faculty were present and completed the rubric for each speaker. The Graduate Program Director collected the rubrics and tabulated the results seen below.

Results:

Overall, the student...	Student 1	Student 2	Student 3	Student 4	Student Average
1. Clearly communicated the necessary background information for the project.	3.4	4.0	3.3	4.0	3.7
2. Defined the question(s) that they investigated.	4.0	3.8	4.0	4.0	4.0
3. Formed a hypothesis based on existing theories and their own observations.	2.8	3.6	3.7	3.8	3.5
4. Designed experiments to collect data in a thoughtful and reproducible manner.	3.6	3.8	3.8	4.0	3.8
5. Analyzed the data collected and explained it in great detail.	3.8	3.8	3.3	3.8	3.7
6. Drew conclusions from the correctly interpreted data thereby generating new knowledge.	3.8	3.8	3.2	4.0	3.7
7. Provided future directions to the project.	3.8	3.0	1.8	3.8	3.1
8. Used literature properly in the presentation.	3.4	3.8	2.5	4.0	3.4
9. Used effective word choice, technical vocabulary, grammar, spelling, coherent speech, etc.	3.4	4.0	3.3	4.0	3.7
10. Did an excellent job applying the Scientific Method to their project.	3.4	4.0	3.1	4.0	3.6

As seen in the table above, the student averages for all categories were between 'somewhat agree' and 'agree.' Of particular note is that students did well to define their research questions, design experiments to collect data in a thoughtful and reproducible manner, analyze the data, and draw conclusions based on the data. These scores indicate that the Chemistry program and mentorship of these four graduate students has prepared them to process data and draw conclusions. However, there was some struggle to form a hypothesis, use literature, and provide future directions to the project. This indicates area of improvement for our program.

Closing the Loop:

Although the scores for applying the scientific method are generally high and in the 'agree' to 'somewhat agree' categories. There is room for improvement. Since program was revamped, students will need to enroll in at least 12 units of the new course CHEM 690: Graduate Laboratory Research (Course description: Practical experience in applying the scientific method to investigate an original research project. Students will develop and test hypotheses to generate new knowledge while maintaining safe lab conditions.). We believe that this course will help students learn and apply the scientific method.

Assessment for the Scientific Method (Spring 2025)

Second Year Seminar
Department of Chemistry, USF
(return to Stevenson, M.)

Student: _____

Evaluator: _____

Key: 1-Disagree 2-Somewhat Disagree 3-Somewhat Agree 4-Agree

Overall, the student...

1. Clearly communicated the necessary background information for the project.

1 2 3 4

2. Defined the question(s) that they investigated.

1 2 3 4

3. Formed a hypothesis based on existing theories and their own observations.

1 2 3 4

4. Designed experiments to collect data in a thoughtful and reproducible manner.

1 2 3 4

5. Analyzed the data collected and explained it in great detail.

1 2 3 4

6. Drew conclusions from the correctly interpreted data thereby generating new knowledge.

1 2 3 4

7. Provided future directions to the project.

1 2 3 4

8. Used literature properly in the presentation.

1 2 3 4

9. Used effective word choice, technical vocabulary, grammar, spelling, coherent speech, etc.

1 2 3 4

10. Did an excellent job applying the **Scientific Method** to their project.

1 2 3 4

Other comments: