

## Program-Level Assessment: Annual Report

Program Name (no acronyms): Chemical Biology

Department: Chemistry

Degree or Certificate Level: MS

College/School: College of Arts & Sciences

Date (Month/Year): August 2021

Assessment Contact: Marvin Meyers

In what year was the data upon which this report is based collected? 2020-2021

In what year was the program's assessment plan most recently reviewed/updated? New program approved in 2018

### 1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

SLU graduates with a MS degree in Chemical Biology will be able to:

**Outcome 1: Assess relevant literature in chemical biology**

Outcome 2: Apply the major practices, theories, or research methodologies in chemical biology.

**Outcome 3: Apply chemistry principles to biology.**

Outcome 4: Articulate arguments or explanations in both oral and written forms.

Outcome 5: Evidence scholarly and professional integrity in chemical biology.

Learning outcomes highlighted in **BOLD font** were assessed in this annual cycle.

This is the second year for the program. In Year 1, learning outcomes 1 (course-based assessment only) and 3 were evaluated. However, due to the fact that only 1 student has defended their Thesis since the program started and the inability to fully evaluate Year 1 outcomes due to impacts by COVID-19 and the biannual offering of CHEB-5630, **Outcomes 1 and 3 were re-evaluated in this Year 2.**

In Year 3, outcomes 2 and 4 will be evaluated. In Year 4, outcomes 1 (thesis-based assessment only) and 5 will be evaluated.

### 2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe and identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

#### Outcome 1

1. CHEB-5630: A grading rubric was used to evaluate this outcome based on student presentations. Points earned for "Content" and "Questions" were summed and converted to % of possible points.
2. CHEM 5470: Performance on a class project & presentation was assessed via use of a grading rubric. The overall average score was used to compile the data.
3. MS Thesis rubric "Background Knowledge" completed by the student's mentor.

#### Outcome 3

1. CHEB-5630: The final cumulative exam score was used to gauge student mastery of this outcome.
2. CHEM-4470: The average of all three exams given in the course was used to gauge this outcome. Combined

data from Spring 2020 and Spring 2021 were used to give a more complete dataset.

Madrid does not have a graduate program in Chemical Biology.

No courses in this assessment were offered online or off-campus. The exceptions to this were: (1) due to the mid-semester Spring 2020 modification to CHEM 5470 to an online form due to COVID-19, and (2) CHEM-5470 and CHEB-5630 were offered in a hybrid synchronous format for the 20-21 school year.

### 3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (do not just refer to the assessment plan).

Data was collected by course instructors and is summarized on the attached spreadsheet. The rubrics used for source data are attached as well.

Data was analyzed by the Chemical Biology Program Coordinator and reported to department faculty for feedback.

### 4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

#### Outcome 1

1. CHEB-5630: 5 of 5 students met or exceeded expectations on their literature presentation.
2. CHEM 5470: 5 of 5 students exceeded expectations on their research paper and presentation.
3. MS Thesis. Data was not assessed since only one student has completed their MS Thesis at the time this data was collected. It is worth noting that there are not red flags at this point and all 3 students completed their second year of the program and will be completing their thesis and defense in the coming month or two.

#### Outcome 3

1. CHEB-5630: 5 of 5 students met or exceeded expectations on the cumulative CHEB-5630 final exam.
2. CHEM-5470: 5 of 5 students met or exceeded expectations CHEM 5470 exams.

It should be noted that this is the second year of the program and the number of MS students is small, which may skew the results.

### 5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

Based on our analysis, our MS students are meeting or exceeding expectations, although we were limited in our assessment this year due to small sample size.

### 6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

The results of the assessment were shared with the full faculty during our annual department retreat in August 2021.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies

- Course content
- Teaching techniques
- Improvements in technology
- Prerequisites
- Course sequence
- New courses
- Deletion of courses
- Changes in frequency or scheduling of course offerings

Changes to the Assessment Plan

- Student learning outcomes
- Artifacts of student learning
- Evaluation process
- Evaluation tools (e.g., rubrics)
- Data collection methods
- Frequency of data collection

Please describe the actions you are taking as a result of these findings.

This is our first year assessing these outcomes using these metrics. No changes are being made with respect to these two outcomes.

If no changes are being made, please explain why.

There are no major concerns given the sample size and all of our students are meeting or exceeding expectations.

## 7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

No specific changes to the program have been made as this is only the second year of the program and last year's assessment was significantly affected by the COVID-19 pandemic.

The original Program Assessment Plan was approved as part of the approval of the major in 2018 without development of the specific rubrics needed for assessment. In the past year, specific rubrics were developed to assess Outcomes 1-4 so that we can continuously collect data for relevant portions of these outcomes on an annual basis. The revised Assessment Plan (attached) has been further updated to reflect these more specific modes of data collection.

B. How has this change/have these changes been assessed?

n/a

C. What were the findings of the assessment?

n/a

D. How do you plan to (continue to) use this information moving forward?

Rubrics on will be used to collect data annually so that we can assess larger sample sizes (3 years' worth of data) in the coming years when the outcome(s) are scheduled for review.

**IMPORTANT: Please submit any assessment tools (e.g., rubrics) with this report as separate attachments or copied and pasted into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document.**

**Course Performance - MS Students**  
**Academic Year 2021-2021**  
**Program Year 2**

**Assessment Cycle: Year 2**

Year 1: Learning outcomes 1 (course-based) and 3

Year 2: Learning outcomes 2 and 4

Year 3: Learning outcomes 5 and 1 (thesis-based)

Outcome 1: Assess relevant literature in chemical biology							
Data Source	>90% - Exceeds Expectations (Rubric 4 = Excellent)	70 - 89% - Meets Expectations (Rubric 3 = Good)	65 - 69% - Approaching Expectations (Rubric 2 = Fair)	<65% - Not meeting expectations (Rubric 1 = Poor)	Total	Assessment	Notes
CHEB 5630 rubric for literature presentation	4	1			5	5 of 5 students met or exceeded expectations	Points earned for "Content" and "Questions" were summed and converted to % of possible points from rubrics for each student
CHEM 5470 rubric for research paper and presentation	5				5	5 of 5 students exceeded expectations	% of points earned for course rubric for research paper and presentation
MS Thesis rubric: "Background Knowledge"		1			1	Data was not assessed since only one student has completed their MS Thesis at the time this data was collected.	
Outcome 2: Apply the major practices, theories, or research methodologies in chemical biology.							
Data Source	>90% - Exceeds Expectations (Rubric 4 = Excellent)	70 - 89% - Meets Expectations (Rubric 3 = Good)	65 - 69% - Approaching Expectations (Rubric 2 = Fair)	<65% - Not meeting expectations (Rubric 1 = Poor)	Total		
MS Oral Exam rubric: Average of first two criteria rounded to nearest whole number	1				1		
MS Thesis rubric: "Presentation of Advanced Research"		1			1		
Outcome 3: Apply chemistry principles to biology.							
Data Source	>90% - Exceeds Expectations	70 - 89% - Meets Expectations	65 - 69% - Approaching Expectations	<65% - Not meeting expectations	Total		Notes
CHEB 5630 final cumulative exam score	2	3			5	5 of 5 students met or exceeded expectations	Course is only offered every even year in the fall so all 5 students in the program took the course Fall 2020. Final exam is cumulative.
CHEM 5470 exam average	2	3			5	5 of 5 students met or exceeded expectations	Combined data from Spring 2020 and Spring 2021. Average of all exams in the course (there is no cumulative exam)
Outcome 4: Articulate arguments or explanations in both oral and written forms.							
Data Source	>90% - Exceeds Expectations (Rubric 4 = Excellent)	70 - 89% - Meets Expectations (Rubric 3 = Good)	65 - 69% - Approaching Expectations (Rubric 2 = Fair)	<65% - Not meeting expectations (Rubric 1 = Poor)	Total		Notes
MS Oral Exam rubric: Last criteria score ("Communicate...")		1			1		
MS Thesis rubric: Overall Avg Score		1			1		
Outcome 5: Evidence scholarly and professional integrity in chemical biology.							
Data Source	>90% - Exceeds Expectations	70 - 89% - Meets Expectations	65 - 69% - Approaching Expectations	<65% - Not meeting expectations	Total		Notes
CHEB 5110 ethics module							

CHEM 5630: Introduction to Chemical Biology and Biotechnology  
Oral Presentation Scoring Sheet

Presenter: \_\_\_ Discussion leader: \_\_\_\_\_

Content

- Presentation is organized
- Material is covered with adequate depth
- Subject is appropriate and relevant
- Uses examples to clarify and add interest
- Demonstrates use of multiple sources

Notes:

\_\_\_ Score out of 25. (25 = excellent, 20 = very good, 15 = good, 10 = fair, 5 = poor)

Delivery

- Audible
- Understandable
- Prepared
- Attitude, confidence, and enthusiasm
- Effective use of time

Notes:

\_\_\_ Score out of 10. (10 = excellent, 8 = very good, 6 = good, 4 = fair, 2 = poor)

Questions

Notes:

Handled questions well during discussion of your presentation and also did well asking questions during Ali's presentation.

\_\_\_ Score out of 5. (5 = excellent, 4 = very good, 3 = good, 2 = fair, 1 = poor)

\_\_\_ **Deductions (late assignment, etc.)**

\_\_\_ **Total score out of 40**

## CHEM-5470 Research Paper Rubric

Name \_\_\_\_\_

Standards	5 - 4 Exemplary	3 - 2 Satisfactory	1 - 0 Weak	Score	Weight	Total Score
Introduction	Provides background research into the topic and summarizes important findings from the review of the literature; describes problem to be solved; explains the significance of the problem to an audience of non-specialists	Provides background research into the topic and describes the problem to be solved	Provides background research into the topic but does not describe the problem to be solved; insufficient or nonexistent explanation of details to non-specialists		x 3	
Discussion	Integration of Knowledge	Discusses at least four topics covered during the course. Demonstrates full understanding and application of concepts learned in course. Chemical detail of structures and discussion is accurate.	Discusses three topics covered during the course. Demonstrates satisfactory understanding and application of concepts learned in course. Chemical detail of structures and discussion are mostly accurate.		x 4	
	Depth	Paper presents a complete story of the discovery of the selected drug, including medical need, biological target or assay, medicinal chemistry optimization, and development.	Paper presents a partial story of the discovery of the selected drug.		x 4	
	Cohesiveness	Addresses the topic with clarity; organizes and synthesizes information; and draws conclusions	Addresses the topic; lacks substantive conclusions; sometimes digresses from topic of focus	Presents little to no clarity in formulating conclusions and/or organization		x 4
Summary	Presents a summary of the topic with clear recommendations and/or implications for future research	Presents a summary of the topic	Missing or does not summarize the topic		x 3	
Mechanics and documentation	Is free or almost free of errors of grammar, spelling, and writing mechanics; appropriately documents sources (ACS style)	Has errors but they don't represent a major distraction; documents sources	Has errors that obscure meaning of content or add confusion; neglects important sources or documents few to no resources		x 2	
Comments				Grand Score (max 100)		

**CHEM-5470 Presentation Rubric**
**Name** \_\_\_\_\_

Standards	5 - 4 Exemplary	3 - 2 Satisfactory	1 - 0 Weak	Score	Weight	Total Score
Organization	Has a clear opening statement that catches audience's interest; maintains focus throughout; summarizes main points	Has opening statement relevant to topic and gives outline of speech; is mostly organized; provides adequate "road map" for the listener	Has no opening statement or has an irrelevant statement; gives listener no focus or outline of the presentation		x 2	
Content	Demonstrates substance and depth; is comprehensive (4 med chem topics covered); shows mastery of material	Covers topic; uses appropriate sources; is objective	Does not give adequate coverage of topic; lacks sources		x 4	
Quality of conclusion	Delivers a conclusion that is well documented and persuasive	Summarizes presentation's main points; draws conclusions based upon these points	Has missing or poor conclusion; is not tied to analysis; does not summarize points that support the conclusion		x 1	
Delivery	Has natural delivery; modulates voice; is articulate; projects enthusiasm, interest, and confidence; uses body language effectively	Has appropriate pace; has no distracting mannerisms; is easily understood;	Is often hard to understand; has voice that is too soft or too loud; has a pace that is too quick or too slow; demonstrates one or more distracting mannerisms		x 1	
Use of media	Uses slides effortlessly to enhance presentation	Looks at slides to keep on track; uses an appropriate number of slides	Relies heavily on slides and notes; makes little eye contact; uses slides with too much text		x 1	
Response to Questions	Demonstrates full knowledge of topic; explains and elaborates on all questions	Shows ease in answering questions but does not elaborate	Demonstrates little grasp of information; has undeveloped or unclear answers to questions		x 1	
Comments				Grand Score (max 50)		

SLU Chemical Biology – MS Thesis

	<b>1 (Poor)</b>	<b>2 (Fair)</b>	<b>3 (Good)</b>	<b>4 (Excellent)</b>	<b>Score</b>
Thesis Format	<i>The organization of the thesis is confusing and/or the length is not appropriate. The references may not be appropriately formatted.</i>	<i>The organization of the thesis is, in places, confusing and/or the length is not appropriate. References may not be appropriately formatted. More emphasis should be placed on several of the sections.</i>	<i>The thesis is well-organized and is of appropriate length. References are appropriately formatted. More emphasis should be placed on a few of the sections.</i>	<i>The thesis is well-organized and is of appropriate length. Chapters are balanced appropriately. References are appropriately formatted.</i>	
Background Knowledge	<i>Demonstrates limited knowledge of chemical and biological principles and the current literature.</i>	<i>Demonstrates adequate knowledge of chemical and biological principles and an awareness of the current literature, but does not identify unanswered questions in the field.</i>	<i>Demonstrates sufficient knowledge of the current literature and chemical and biological principles. Correctly identifies and understands the importance of unanswered questions in the field.</i>	<i>Demonstrates the ability to apply fundamental concepts to advanced topics in chemistry/biology and in-depth knowledge of the current literature. Correctly identifies and illustrates the importance of unanswered questions in the field and presents his/her work within the context of these questions.</i>	
Presentation of Advanced Research	<i>The aims/objectives and/or the rationale for the project are not adequately described. The experimental approach is neither clearly defined nor logical. Results and discussion are limited.</i>	<i>Aims/objectives are described, however, the rationale for the aims/objectives is unclear. The experimental approach is clearly defined and logical, however the results and discussion lack clarity.</i>	<i>Aims/objectives are described. A rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results are presented and interpreted, but additional discussion should be provided.</i>	<i>The aims/objectives are clearly described and provide a logical framework to address a problem. A compelling rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results and discussion are complete.</i>	
Written Communication	<i>Fails to clearly communicate results and conclusions.</i>	<i>Adequately communicates results and conclusions, however supporting information and explanations are missing.</i>	<i>Successfully communicates results and conclusions, supporting information and explanations are provided.</i>	<i>Results and conclusions are not only successfully summarized and supported, but are also analyzed in the context of the field.</i>	

Comments:

**SLU Chemical Biology – Final Defense Rubric for MS students**

	<b>1 (Poor)</b>	<b>2 (Fair)</b>	<b>3 (Good)</b>	<b>4 (Excellent)</b>	<b>Score</b>
Demonstrate advanced level knowledge in both (i) synthesis and materials chemistry and (ii) analytical and physical chemistry methods, with a higher level of knowledge expected in the student's area of focus	<i>Student lacks basic knowledge in chemistry and biology topics.</i>	<i>Student displays knowledge, but is weak in several key concepts.</i>	<i>Student displays knowledge, with minor weaknesses.</i>	<i>Student displays great knowledge chemistry and biology topics.</i>	
Acquire the basic tools, including chemical practices and theories, needed to conduct advanced chemical research. Students will become proficient in their specialized area of chemistry and complete an advanced research project.	<i>Student has make limited progress on an advanced research project.</i>	<i>Some progress has been made on an advanced research project.</i>	<i>Sufficient progress has been made on an advanced research project.</i>	<i>Significant progress has been made on an advanced research project.</i>	
Communicate scientific findings from literature and original findings from the student's own advanced research.	<i>Student unable to clearly communicate chemical and biological topics.</i>	<i>Student can sometimes communicate chemical topics effectively.</i>	<i>Student can effectively communicate chemical topics.</i>	<i>Student can communicate chemical and biological topics effectively and compellingly.</i>	

Comments:

**Please return to the Chemical Biology Program Coordinator**

## Program Assessment Plan

**Program:** MS in Chemical Biology  
**Department:** Chemistry  
**College/School:** College of Arts & Sciences  
**Date:** August 2021  
**Primary Assessment Contact:** Marvin Meyers

**Note:** Each cell in the table below will expand as needed to accommodate your responses.

#	Program Learning Outcomes	Assessment Mapping	Assessment Methods	Use of Assessment Data
	<p>What do the program faculty expect all students to know, or be able to do, as a result of completing this program?</p> <ul style="list-style-type: none"> <li>Note: These should be measurable, and manageable in number (typically 4-6 are sufficient).</li> </ul>	<p>From what specific courses (or other educational/professional experiences) will artifacts of student learning be analyzed to demonstrate achievement of the outcome? Include courses taught at the Madrid campus and/or online as applicable.</p>	<p>What specific artifacts of student learning will be analyzed? How, and by whom, will they be analyzed?</p> <ul style="list-style-type: none"> <li>Note: the majority should provide direct, rather than indirect, evidence of achievement.</li> </ul> <p>Please note if a rubric is used and, if so, include it as an appendix to this plan.</p>	<p>How and when will analyzed data be used by faculty to make changes in pedagogy, curriculum design, and/or assessment work?</p> <p>How and when will the program evaluate the impact of assessment-informed changes made in previous years?</p>
1	Assess relevant literature in chemical biology	CHEM-5630 (Chemical Biology) CHEM-5470 (Med Chem) Master's Thesis	<p>Course-specific rubrics will be used to collect student learning data from student literature papers written for CHEB-5630, CHEM-5470, and the Master's Thesis. The rubric will be completed by the course instructors as they grade the papers and by the mentor as they assess the Master's Thesis.</p> <p>The data will be analyzed by the Chemical Biology Program Coordinator and a small team of faculty.</p>	Assessment data will be collected on a 3-year rotating basis. A summary of the results will be shared with the faculty annually and adjustments to the curriculum and/or assessment process will be made as needed.
2	Apply the major practices, theories, or research methodologies in chemical biology	Master's Thesis MS Oral Examination	Rubrics are used to collect student learning data from the Master's thesis and oral examination. The rubric will be	Assessment data will be collected on a 3-year rotating basis. A summary of the results will be shared with the

			<p>completed by the research mentor and examination committee.</p> <p>The data will be analyzed by the Chemical Biology Program Coordinator and a small team of faculty.</p>	<p>faculty annually and adjustments to the curriculum and/or assessment process will be made as needed.</p>
3	Apply chemistry knowledge to address questions in biology	CHEM-5630 (Chemical Biology) CHEM-5470 (Med Chem)	<p>The final exam in CHEB-5630 (cumulative) and average of exam scores in CHEM-5470 will be used to gauge student mastery of this learning outcome.</p> <p>The data will be analyzed by the Chemical Biology Program Coordinator and a small team of faculty.</p>	<p>Assessment data will be collected on a 3-year rotating basis. A summary of the results will be shared with the faculty annually and adjustments to the curriculum and/or assessment process will be made as needed.</p>
4	Articulate arguments or explanations in both oral and written forms	Master's Thesis MS Oral Examination	<p>Rubrics are used to collect student learning data from the Master's thesis and oral examination. The rubric will be completed by the research mentor and examination committee.</p> <p>The data will be analyzed by the Chemical Biology Program Coordinator and a small team of faculty.</p>	<p>Assessment data will be collected on a 3-year rotating basis. A summary of the results will be shared with the faculty annually and adjustments to the curriculum and/or assessment process will be made as needed.</p>
5	Evidence scholarly and professional integrity in chemical biology	CHEB-5110 (Intro to Chem Biol Research 1) Master's Thesis MS Oral Examination	<p>Select exam questions in CHEB-5110 will be used to gauge student mastery of this learning outcome.</p> <p>A rubric will be developed and used to collect student learning data from the Master's thesis and oral examination. The rubric will be completed by the research mentor and examination committee.</p> <p>The data will be analyzed by the Chemical Biology Program Coordinator and a small team of faculty.</p>	<p>Assessment data will be collected on a 3-year rotating basis. A summary of the results will be shared with the faculty annually and adjustments to the curriculum and/or assessment process will be made as needed.</p>

### Additional Questions

1. On what schedule/cycle will faculty assess each of the above-noted program learning outcomes? (*It is not recommended to try to assess every outcome every year.*)

Year 1: Learning outcomes 1 (course-based) and 3

Year 2: Learning outcomes 2 and 4

Year 3: Learning outcomes 5 and 1 (thesis-based)

2. Describe how, and the extent to which, program faculty contributed to the development of this plan.

The plan was originally approved when the Chemical Biology Masters program was developed. Substantial changes will be approved by the faculty (no substantial changes have been made to date).

3. On what schedule/cycle will faculty review and, if needed, modify this assessment plan?

Every 3 years.

***IMPORTANT: Please remember to submit any assessment rubrics (as noted above) along with this report.***