

The Department of Chemistry and Biochemistry
Assessment Report– PhD Programs- Academic Year 2016/2017

MSU's Mission

Montana State University, the state's land grant institution, educates students, creates knowledge and art, and serves communities by integrating learning, discovery and engagement.

The Department of Chemistry and Biochemistry Mission

The mission of the Department of Chemistry and Biochemistry is to provide students with educational experiences that empower and guide them to think critically and creatively for long term professional success in their chosen fields.

The following assessment report highlights the Department of Chemistry and Biochemistry's Ph.D. programs in chemistry and biochemistry based on data from Fall of 2015 through Spring of 2017. The report begins with facts about the program in the last ~2 years and then presents information on the Department's and the Graduate School's requirements. Data on Ph.D. learning outcomes are also presented.

Facts about the Program

- 67 graduate students were enrolled in the Fall of 2015.
- 67 graduate students were enrolled in the Fall of 2016.
- 2 Ph.D. students were accepted in the Spring of 2017 (not included in table below)
- 15 new graduate students will be attending MSU in the Fall of 2017 (not included in table below).

Table 1 below provides the number of graduate students in the program based on their entering class year. Of the current total (67) in the Fall of 2016, 4 students were on either a thesis or coursework (CW) Master (MS) track. All other students are pursuing a Ph.D. in chemistry or biochemistry.

Table 1 – Current Students in the Department According to Entering Year

2016	2015	2014	2013	2012	2011	2010	2008
12	11	11	10	10	7	5	1

- Of the last 2 entering classes (2015 and 2016), only one Ph.D. student who entered in 2015, transferred to a different university with a professor who left the department.
- Two other students left in the summer of 2015. One student on the MS track failed to obtain their degree and one PhD student left because she was not in good standing.
- A Ph.D. student who entered in 2010 left the program in the Fall of 2016 without a degree.

The next section of the documents provides information on both department and The Graduate School Requirements.

1. Qualifying Exams

All first year students take qualifying exams (proficiencies) to demonstrate their preparedness for an advanced degree in our program. The exams are a department requirement. Students are required to pass 3 proficiency exams in their first year of graduate school to remain in good standing. The exams are offered 4 times a year and except for the structural and molecular biology exam, all exams are standardized American Chemistry Society (ACS) exams given in 5 different sub-disciplines. The outcome for any exam can be a Full Pass (FP) Master Pass (MP) or a No Pass (NP). As determined by the well-publicized ACS norms, a FP is set at the 55th percentile, the MP is set at ~ 50th percentile and scores below the 50th percentile are considered a NP. The names and results of each student who took proficiencies in the entering classes of 2015, and 2016 appear in Appendix A (data not shown).

Results:

Entering Class of 2015 – Of the 9 students taking the proficiency exams, all student have the met the department requirement of passing 3 exams.

Entering Class of 2016 - Of the 12 students taking the proficiency exams, all of them have passed the proficiency requirement.

2. Comprehensive Exams

The Graduate School requires a comprehensive exam after 2/3 of a student's coursework has been completed. Typically our department has students defend written and oral portions of the exam (at the same time) during the student's second semester of their second year of graduate school. See Appendix B (data not shown) for names of those students who defended the exams in AY 2015/2016, and AY 2016/2017. A summary of the results are below.

Eleven students that were in good standing from the class of 2014 successfully defended their written and oral comprehensive exams in either spring of 2016 or the fall of 2016. One student in the class of 2014 changed from a Ph.D. track to an MS after she defended her comprehensive exam. Of the entering class of 2015, 8 students successfully defended their comprehensive exams in the spring of 2017. One student transferred to a different program and one student switched to an MS coursework option and did not take the comprehensive exam.

3. Department Requirement- 4th year seminar

The Department of Chemistry and Biochemistry requires that all students in their 3rd or 4th year of graduate school give a public research seminar. The students meet with their Ph.D. committees after their seminar to discuss relevant research questions and to obtain feedback from their committee on progress to date and time of expected graduation. It is assumed that the student will graduate with their degree ~ 1-2 years after they give their seminar.

Completed seminar in year 2015

7 students completed this requirement.

Completed seminar in 2016

5 students completed this requirement

Completed Seminar in 2017

4 students completed this requirement

4. Graduation

Table 2 summarizes our graduation statistics for the last 8 years. Figure 1 (conclusion section) depicts a longitudinal overview of degrees awarded since 1999. The names of students who graduated in the 2015, 2016 and currently in 2017 appear in Appendix C (data not shown).

Table 2 Graduation Statistics

Degree	N	Average Credits	Average GPA	Average #yrs to graduate
2009 (Jan-Dec)				
MS	4	42.5	3.51	2.8
PhD	7	76.3	3.7	5.7
2010				
MS	3	38	3.67	3
PhD	8	80.5	3.75	5.4
2011				
MS	7	47.85	3.55	3.7
PhD	4	72.5	3.74	5
2012				
MS	6	39.5	3.46	3.3
PhD	6	78.33	3.7	5.7
2013				
MS	4	45.25	3.66	3.5
PhD	8	85.15	3.72	6.3
2014				
MS	1	47	3.55	4
PhD	13	69.91	3.59	5.8
2015				
MS	3	33.0	3.42	2.5
PhD	14	69.13	3.75	5.7
2016				
MS	6	32.6	3.26	2.58
PhD	12	67.41	3.35	5.27
2017(May-August)				
MS	2	43.5	3.69	3.5
PhD	6	66	3.50	5.83

Program Learning Outcomes

For doctoral students:

1. Demonstrate mastery of subject content knowledge.
2. Demonstrate effective oral and written communication skills.
3. Conduct independent research and analysis in their discipline and contribute original and substantive work in their field.
4. Demonstrate independent scientific thinking and advanced knowledge in their current discipline and in related areas of their discipline.
5. Demonstrate knowledge of basic lab safety and the requirements to assist in establishing a safe lab environment.
6. Understand ethical issues and responsibilities especially in matters related to professionalism, data collection, the laboratory setting and in writing and publishing theses, dissertations and scientific papers.
7. Professionalization into the field of study: publications, presentations, attended conferences, received funded fellowships, and professional association activities.

Program Learning Outcomes 1-4;

We created a rubric to evaluate learning outcomes 1-4. For ease in the assessing, outcomes 1, 3 and 4 were combined to evaluate students at their PhD or MS defenses. We evaluated the student separately on written and oral communication skills.

In the Fall of 2014, we began to distribute the rubric to 3 faculty members on a student's committee at the student's Ph.D. and M.S defenses. The overall scores for each of the outcomes assessed were averaged for each student. For each learning outcome, an average score of 1 was unacceptable; 2 was acceptable and 3 exceptional. Data were collected on 16 Ph.D students (Fall 2015-spring 2017.)

On the outcome "the student has effective oral communication skills", 100% of our students averaged a score of 2 (acceptable) or better. On the outcome "the student has effective written communication skills, all 16 students averaged a 2 (acceptable) or better (tendency for exceptional). On the combined outcomes of 1, 3 and 4 "the student demonstrated mastery of subject content and successfully conducted independent research and analysis contributing original substantive work in their field" all 16 students averaged a 2 (acceptable) or better.

All 16 students (assessed) earned a Ph.D. in either chemistry or biochemistry.

Program Learning Outcomes 5 and 6;

All entering students complete ethics training with either the Graduate School and/or the Department of Chemistry and Biochemistry. For the past 3 years, during orientation for the first year graduate students, Professor Mary Cloninger has presented an ethics in research module

for all incoming graduate students. In addition to this classroom time, students have completed an online training certification through the Collaborative Institutional Training Initiative (CITI) offered through the University of Miami ([https://www.citiprogram.org/.](https://www.citiprogram.org/)) Students had to attend the classroom training session with Professor Mary Cloninger and pass the necessary CITI online training modules and quizzes in order to be a student in good standing in our department. We will continue this training every year for the new incoming graduate students. Last year (Fall 2016) our incoming students also had a training session in research compliance, ethics and legal issues with the Graduate School's orientation session in August.

In the Fall of 2015, the department head implemented a mandatory fire safety training for all graduate students and TAs affiliated with the department. All graduate students in the department of chemistry and biochemistry completed a 90 min fire safety training with Skip Hougland from MSU's Safety and Risk Management. In addition to mandatory fire safety training, all entering students for the past three years (n=35) participated in a 3-day teaching training orientation with Professor Chris Bahn. This training included a 45 minutes session on laboratory safety. All first year students in the department have to complete an online laboratory safety course through Safety and Risk Management in order to be in good standing with the department. This training will continue forward with every new entering graduate class.

Learning Outcome 7

For the learning outcome of "professionalization into the field of study: publications, presentations, attended conferences, received funded fellowships, and professional association activities, we initially thought that we would collect CVs from the students who obtained a Ph.D. from our department. While some students did email the graduate program director the information, multiple emails to students did not achieve the desired results. We eliminated this form of data collection and relied on the "thesis points" document. The thesis points document is a requirement for our PhD students to complete before their scheduled defense. The thesis point of one of our students can be found in Appendix E (data not shown).

From 1999-2005 the number of students that left the program without a degree was alarming. We now can account for every student leaving the program (after 2005) and provide a reason for their departure. The information gleaned can be useful. We are on average graduating our students in both chemistry and biochemistry PhD programs in less than six years. We ramped up our recruiting efforts in the Fall of 2016 with a newly formed department recruiting committee with the task to increase the number of students entering our graduate programs. Our Fall 2017 entering class is currently at 15 people and we are still receiving late applications.

Finally, the data reveal the department is succeeding in reaching its mission to graduate students with strong educational experiences that guide them for long-term professional success. With the exception of a few graduates in May of 2017 graduating class, all of our PhD graduates have found professional positions at universities or major research laboratories.

We are not making any major changes to our Ph.D. program in chemistry or biochemistry.