REVIEW OF THE M.S. IN CHEMISTRY
Classification of Instructional Programs (CIP) Code: 40.0501
Chemistry, General

OVERVIEW

The M.S. in Chemistry program at Illinois State University is housed in the Department of Chemistry within the College of Arts and Sciences. The Department offers a comprehensive suite of programs, including a Minor in Chemistry, a B.S. in Chemistry (with a Chemistry Teacher Education sequence), a B.S. in Biochemistry, and three graduate-level programs: the M.S. in Chemistry, the M.S. in Chemistry Education (M.S.C.E.), and the Master of Chemistry Education (M.C.E.). The M.S. in Chemistry is a thesis-based program that requires coursework across at least four sub-disciplines—analytical, inorganic, organic, physical, biochemistry, and chemical education—and culminates in a research thesis. Students work closely with faculty mentors in collaborative, laboratory-based research environments and regularly present at regional and national conferences. While students enter the program without formal sequences, they may choose to specialize in an area of interest through elective coursework and thesis research. The Department maintains approval from the American Chemical Society and emphasizes student engagement, individualized mentoring, and scholarly productivity as hallmarks of the graduate experience.

Enrollment and Degrees Conferred by Plan of Study, Fall Census Day, 2017-2024
M.S. in Chemistry, Illinois State University
First Majors Only

	2017	2018	2019	2020	2021	2022	2023	2024
Enrollments	26	29	27	17	26	27	26	28
Degrees	8	9	10	7	14	6	9	11

Table notes:
Graduating Fiscal Year consists of summer, fall, and spring terms, in that order. For example, Graduating Fiscal Year 2024 consists of the following terms: summer 2023, fall 2023, and spring 2024.

EXECUTIVE SUMMARY
PROGRAM REVIEW SELF-STUDY REPORT

Self-study process

The Department Chairperson coordinated with various stakeholders to formulate this self-study. Faculty and staff were engaged in numerous ways, including organizational meetings, charges given to individuals or Departmental committees, and large group discussions involving the entire community. In addition, resources provided by the American Chemical Society (ACS) were consulted to ensure that our program provides students with the skills they need to succeed in a career in the chemical sciences.

Program curriculum

At the undergraduate level, the Department offers a minor in chemistry and two majors (a B.S. in Chemistry and a B.S. in Biochemistry). The Chemistry degree also has a track in chemical education (CTE). At the graduate level, the Department offers an M.S. in Chemistry and two online master's programs in teacher education – the Master of Science in Chemistry Education and the Master of Chemistry Education. We are an ACS-approved Department - please see the section on special accreditation for additional details. The M.S. in Chemistry requires coursework in four of five specializations in the field of chemistry along with intensive research experience culminating in a thesis.

Academic unit faculty

The number of faculty within the Department has varied throughout the review period. Our faculty are involved in the direct instruction of all of our courses and provide individualized attention whenever possible. The Department strongly supports student involvement in research. Nearly all of our tenure/tenure-track faculty have vibrant research programs that regularly result in peer-reviewed publications and presentations at regional/national venues that involve student co-authors. Opportunities to participate in undergraduate research are offered via the CHE 290/299 courses, which can fulfill a graduation requirement for the B.S. in Chemistry degree. At the graduate level, all students must complete a thesis that in part combines work performed in CHE 490/499. Our faculty are dedicated Teacher-Scholars who are active within the classroom and research laboratory.

Program goals and quality indices

Our department is proud of the individualized attention that we provide to students within all learning spaces, including traditional classrooms, teaching laboratories, and research laboratories. We are proud of our engagement with students within research. Each academic year, 60-100 students engage in independent research projects mentored by our tenure-track faculty. These works are frequently presented at regional and national meetings. In addition, students are often co-authors of peer-reviewed publications in top-ranking chemistry and biochemistry journals. Currently, faculty from our department holds $3.5 million in active research funding. Additionally, faculty from our department are co-PIs on $3.3 million in active educational grants. Since 2022, the Department has been revising its strategic plan in response to the Biochemistry program review.

Mission & Goals

As a collaborative group of teacher-scholars, the Department of Chemistry at Illinois State University promotes a culture of intellectual engagement while inspiring our community to expand chemical and biochemical knowledge in ways that positively impact society. We engage all students through welcoming classrooms and individualized, collaborative research. Students, Staff, and Faculty are passionate about research and education.

Goals:

1) Provide a student-centered Chemistry and Biochemistry curriculum that is both robust and engaging.
2) Develop and refine Departmental support mechanisms for students and faculty.
3) Define an Equity, Diversity, and Inclusion plan tailored to chemistry and biochemistry.
4) Foster an environment conducive to student and faculty scholarship.

Student learning outcomes assessment plan and process

Our assessment plan at the program level includes four goals. These goals were chosen so that we can ensure that our courses provide students with the necessary background and experience to be successful chemical professionals. Our goals are assessed primarily with data collected from our courses and theses. This data is collected by faculty and the Department Chairperson.

The Department council and the curriculum committee discuss data. However, with the frequent changes in Chairship and the pandemic during this review period, making adjustments based on assessment data and overall evaluation of the assessment instruments was a low priority. See section III.5 for more detail.

Specialized accreditation

The American Chemical Society Committee on Professional Training establishes guidelines and standards for approving bachelor's degree programs in Chemistry. Although these guidelines are for undergraduate education, they provide a valuable reference point for our graduate program. Our undergraduate degree programs undergo an annual review to ensure that courses are offered sufficiently frequently, that Faculty have adequate formal training, and that the Institution offers sufficient resources (e.g., library subscriptions and physical facilities). In addition to the annual review, every five years, the Department undergoes a periodic review that includes providing samples of instructional materials for external review. Some of these courses are approved for graduate credit. We are pleased

to report that the Department underwent the in-depth periodic review in 2022 and that we have maintained good standing as an ACS-approved Department.

Responses to recommendations resulting from the previous program review

The Academic Planning Committee (APC) made several recommendations during the last review. Since that time, the Department had two permanent and one interim Chairperson. In addition, a pandemic took place that had a significant impact on a laboratory-based discipline. These events made continuity challenging, and hence, long-term progress was slow. That said, progress has been made on the recommendations made by the APC.
Specifically, the Department has worked to revise its strategic plan and continue collaborating with the library to maintain sufficient resources to secure continued ACS approval. The APC also recommended that faculty research interests be made more publicly available. The Department has created a faculty research interest flyer, which is regularly updated and distributed to all interested prospective students. Additionally, our website now includes a section devoted to faculty research pursuits. While the data has not been recorded, the racial diversity within our program has increased, driven by the increase in international students, largely from Ghana and Nigeria. The Department has more work to do regarding long-term scheduling within chemistry sub-disciplines. This has been hampered by changes in the Chair position and staffing challenges.

Changes in the academic discipline, field, societal need, and program demand

Within the academic discipline, chemistry programs have increasingly integrated interdisciplinary courses and collaborations with a stronger emphasis on the intersections of chemistry with biology, materials science, environmental science, and data science. In many programs, the curriculum has evolved to include more contemporary topics such as nanotechnology, sustainable chemistry, and data science, with courses on computational chemistry and machine learning applications in chemistry becoming more common. The modern chemical professional is already more likely to identify as an environmental chemist focusing on ecological degradation, climate science, pollution control, renewable energy, and sustainability (green chemistry) or as a biochemist/chemical biologist driven by the boom in biotechnology, pharmaceuticals, and personalized medicine, or as a materials scientist developing new materials for electronics, energy storage, and nanotechnology applications. See section VI for more details.

Major findings of this program review self-study

1) Enrollment in the M.S. in Chemistry degree at ISU is up from 2015 to 2023. In contrast, overall enrollment in M.S. in Chemistry programs in Illinois is down 22%.
2) ISU is one of the top producers of M.S. in Chemistry degrees in Illinois.
3) Faculty numbers have fluctuated throughout the review period.
    a) While the faculty FTE per TT faculty appears constant, activities such as service, scholarship, and engagement in DEI and undergraduate/graduate research are not reflected in FTE.
4) Diversity numbers within faculty are a work in progress, but they are improving.
5) Chemistry requires significant investments in infrastructure and instrumentation. The Department has procedures in place to keep both as up-to-date as possible.
6) Recruitment has primarily relied on university admissions and reputation.
7) The Department continues to maintain ACS approval. While the approval is for undergraduate programs, the ACS approves departments based on a rigorous set of criteria.
8) Our students must participate in research and complete a thesis. They are frequently co-authors on peer-reviewed publications and/or presentations at regional/national-level chemistry conferences.
9) While the Department has seen significant growth in international students, developing and maintaining domestic student pipelines is also of high interest.

Initiatives and plans for the next program review cycle

Action Plan 1: Investigate an accelerated dual degree program
Accelerated degree programs that enable students to earn both a B.S. and M.S. degree are common. Within our in-state comparators, both Western Illinois University and Lewis University have accelerated degree programs in Chemistry. While it is not uncommon for our B.S. students to decide to stay at ISU for a Master's degree, we do not

offer or advertise for an accelerated program. The steps to achieve this goal are straightforward and involve an analysis of our undergraduate and graduate curriculum. Discussion will take place within the Department to determine if such an accelerated dual degree program is appropriate at ISU and would serve our students.

Action Plan 2: Investigate graduate program offerings
Examining our high-performing in-state comparator institutions shows that all of them offer non-thesis-based MS degrees. This starkly contrasts our program, in which a thesis-based option is the only pathway to a degree. This gave the Department pause and given the overall enrollment trend within the state for M.S. in Chemistry degrees, it is worth our time to investigate the type of graduate education the Department offers. This study would need to start with a grassroots approach, and it should include out-of-the-box thinking. We should consider why we only offer a thesis-based M.S. in Chemistry and what other degree or certificate programs we could offer.

PROGRAM REVIEW OUTCOME AND RECOMMENDATIONS FROM THE ACADEMIC PLANNING COMMITTEE

Review Outcome. The Academic Planning Committee, as a result of this review process, finds the M.S. in Chemistry to be in Good Standing.

The Academic Planning Committee thanks the program for its efforts in completing the self-study report. The committee acknowledges the depth of faculty expertise, with the majority of faculty at the full professor rank and commends the program's strong research emphasis. The thesis-based structure ensures students engage in meaningful, original investigations that often lead to conference presentations, co-authored publications, and advanced research skills. These opportunities profoundly enhance professional development and prepare graduates for both doctoral study and direct entry into the chemical industry.

While many M.S. in Chemistry programs statewide experienced declines since 2015, the program at ISU has maintained a relatively stable and, at times, improved enrollment level. This resilience, especially amid fluctuating statewide trends, suggests that the program's reputation, robust research offerings, and supportive faculty mentorship attract a steady stream of candidates—particularly from international pools. However, domestic enrollment and gender balance remain areas of opportunity. A more proactive recruitment strategy could help ensure that the program not only maintains stability but also grows in directions that broaden its demographic profile.

The committee also recognizes that the program engages in various activities to support student success. In addition to formal coursework and thesis research, students benefit from strong faculty advising, departmental seminars featuring diverse speakers, and professional development opportunities such as conference travel and workshops on scientific communication. These co-curricular activities help foster a sense of community, assist students in navigating the challenges of graduate-level study, and enhance their readiness for future careers.

Despite these strengths, the committee notes several areas needing attention. The program's stable enrollment reflects success in certain markets (notably international) but reveals gaps in broader domestic outreach and in achieving a more balanced demographic composition. Currently, the program lacks a comprehensive and data-driven recruitment strategy to diversify its applicant pool, address gender imbalances, and ensure long-term growth.

Additionally, while new graduate courses have been introduced, their goals and impact on the curriculum remain unclear. More intentional alignment with evolving disciplinary trends—such as sustainable chemistry, computational methods, and interdisciplinary specializations—could increase the program's attractiveness. Incorporating equity, diversity, and inclusion (EDI) more explicitly into the curriculum, rather than relying primarily on international enrollments, would enrich the learning environment and better prepare students for a global and inclusive workforce.

Assessment is another key area for development. Although the program reports minimal attrition and strong completion rates, it does not provide systematic evidence or data-driven measures to confirm these outcomes. By establishing a graduate-level assessment framework—distinct from the undergraduate model—the program can clearly define M.S.-level learning outcomes, measure student achievement in research and professional skills, and use these findings to refine curricula and document program strengths.

The committee also notes that while the program acknowledges models at comparator and aspirational institutions (e.g., considering non-thesis tracks or "4+1" accelerated options), it has not articulated how these insights might inform concrete changes at ISU. Exploring these models thoroughly and adapting them as appropriate could ensure that the program remains flexible, modern, and responsive to student and industry demands.

Follow-Up Reports

Assessment plan. The Academic Planning Committee recognizes faculty efforts in developing and implementing the assessment. As noted during the review discussion, one key area for development is the program's approach to graduate-level assessment. While the self-study reports strong completion rates and minimal attrition, the program does not currently provide systematic evidence to confirm these outcomes or to assess achievement of its learning goals. The Committee asks that the program faculty develop a follow-up report that describes a graduate-level assessment framework that articulates distinct masters-level outcomes, identifies how those outcomes are addressed through coursework, research, and the thesis process, and outlines a plan for collecting and using evidence of student learning. The report should also describe how assessment results will inform program improvement and how the assessment process will be embedded in the department's ongoing work. The committee asks that the program faculty submit a progress report regarding the implementation of the assessment plan to the Office of the Provost by October 1, 2026.

Comparator and aspirational programs. The committee commends the program for acknowledging external models but encourages a deeper, more action-oriented analysis. Rather than merely cataloging peer practices, the program should identify specific strategies or structures that can be adapted. By October 1, 2026, the program should submit a revised aspirational plan to the Office of the Provost, detailing how insights from comparator programs will inform strategic decisions, curriculum updates, and recruitment initiatives.

Recommendations

In addition to the program's noteworthy efforts and accomplishments, the Academic Planning Committee provided recommendations for consideration. The committee's recommendations outlined below are to be addressed within the next regularly scheduled review cycle. Details describing the actions and outcomes associated with each of the committee's recommendations should be included in the next program review self-study report that is tentatively due October 1, 2032.

Develop a strategic plan for the program. While the self-study report references alignments between the program and college and university goals, the Committee recommends that the program faculty work to develop strategic plan for the program. Such a plan should establish explicit targets for enrollment management (including domestic recruitment and demographic balance), integrate current industry and research trends into the curriculum, and incorporate systematic assessment of student learning. Comparator analyses should also guide these strategic efforts. By establishing clear, measurable objectives with timelines, the program will better respond to challenges identified in this review.

Formalize enrollment management, recruitment, and retention efforts. Develop a data-driven recruitment and retention strategy aimed at attracting a more diverse domestic applicant pool and balancing gender representation. Such efforts will strengthen the program's demographic profile, broaden its appeal, and ensure stable growth.

Strengthen curriculum review and EDI integration. Conduct a comprehensive curriculum review, articulating the purpose and outcomes of new courses and aligning them with contemporary disciplinary trends. Integrate EDI principles into the curriculum to ensure inclusivity and prepare students for a diverse professional environment.

Enhance and utilize assessment for continuous improvement. Establish a formal assessment framework with graduate-level learning outcomes and corresponding measures. Use these data to guide curricular enhancements, validate student success claims, and communicate program value to stakeholders.

Formalize alumni and stakeholder engagement. Move beyond informal alumni connections to implement structured feedback loops. Regular surveys, advisory boards, and alumni-oriented events will provide insights into employment trends, inform curricular changes, and highlight program strengths to prospective students.

Remain current with changes in the discipline. Continuously monitor evolving trends in chemistry education and industry needs. Consider flexible degree paths, emerging sub-disciplines, and interdisciplinary partnerships. Adapting ideas from comparator programs can help maintain competitiveness and relevance.

Continue collaborations with Milner Library. Build upon a strong existing relationship to evaluate and maintain resource availability. Consider expanding digital resources, integrating information fluency outcomes and assessment into the curriculum, and integrating library tools into assessment plans. Such efforts ensure that both faculty and students have ongoing access to the information and skills needed for effective scholarship.