REVIEW OF THE B.S. IN BIOCHEMISTRY

Classification of Instruction Programs (CIP) Code: 26.0202
Biochemistry

OVERVIEW

The **B.S. in Biochemistry** program at Illinois State University is housed in the Department of Chemistry within the College of Arts and Sciences. The Department of Chemistry houses four degree programs: a B.S. in Biochemistry, a B.S. in Chemistry, a M.S in Chemistry, and a M.C.E. or M.S.C.E in Chemistry Education. In addition, the department offers a minor in Chemistry. This is the first review of the B.S. in Biochemistry program as a stand-alone program.

The B.S. in Biochemistry program provides a solid foundation necessary for advanced study in medicine, veterinary medicine, pharmacy, chemistry and biology, as well as forming the basis for entry-level positions in the pharmaceutical and biotechnical industries. While the degree requirements may satisfy many professional or graduate programs, it is important to consult the admission requirements as early as possible for the particular programs at schools to which the individual is likely to apply. Additional coursework may be taken as electives which may be applicable to postgraduate work.

Enrollment and Degrees Conferred by Plan of Study, Fall Census Day, 2014-2021
B.S. in Biochemistry, Illinois State University
First Majors Only

	2014	2015	2016	2017	2018	2019	2020	2021
Enrollments	42	62	79	68	67	62	72	69
Degrees	24	15	3	4	8	9	7	5

Table notes: The 2014 and 2015 graduation numbers reflect students graduating from the combined B.S. in Biochemistry/Molecular Biology program that was split into separate stand-alone programs in 2013.

EXECUTIVE SUMMARY
PROGRAM REVIEW SELF-STUDY REPORT

Program goals

Program Goal 1**:** Students will understand the fundamental basis of the science of chemistry through mastering key concepts in the specific areas of physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and biochemistry following guidelines established by the American Chemical Society for a B.S. degree in chemistry.
Program Goal 2**:** Students will develop information and communication skills (oral, written, and computer skills) needed to be a professional chemist.
Program Goal 3**:** Students will develop problem-formulating and problem-solving skills relevant to the field of chemistry
Program Goal 4**:** Student will develop safe and effective laboratory skills, including those for chemical handling and use of chemical instrumentation
Program Goal 5: Students will learn how to translate their knowledge of chemistry into practice.

Student learning outcomes

Program Goal 1 Outcomes**:**

- Understanding of key concepts in: Physical chemistry, organic chemistry, inorganic chemistry, analytical chemistry, biochemistry

Program Goal 2 Outcomes**:**

- Ability to find and retrieve electronic data and information
- Effective at communicating chemical ideas in writing
- Ability to use computer based tools for data analysis, interpretation, and communication
- Effective at orally communicating their knowledge of chemistry

Program Goal 3 Outcomes**:**

- Ability to formulate questions in problem areas in advanced courses and apply problem-solving skills to answer questions/ problems

Program Goal 4 Outcomes**:**

- Laboratory activities that require basic chemical equipment and instrumentation
- Laboratory work that shows safe and effective practices in laboratory procedures, chemical handling and use of equipment

Program Goal 5 Outcomes:

- Completion of supervised, independent work that demonstrates putting knowledge into practice

Program curriculum (2021-2022)

Graduation requirements:
120 credit hours including 75 credit hours for the degree program and 39 credit hours for General Education. The 75 credit hours for the degree program include 45 credit hours of chemistry courses, 14 credit hours of biology courses, 8 credit hours of mathematics courses, and 8 credit hours of physics courses.

Program delivery

The program is offered on the Normal campus.
The program is delivered primarily through face-to-face instruction.

Department faculty (Fall 2021)

21 tenure track faculty members (12 Professors, 3 Associate Professors, and 6 Assistant Professors)
7 non-tenure track faculty members (5 full-time, 2 part-time, totaling 5.9 FTE)
Undergraduate student to faculty ratio: 7 to 1
Undergraduate student to tenure-line faculty ratio: 8 to 1

Specialized accreditation

B.S. in Biochemistry degrees are American Chemical Society (ACS) certified in the Department as long as the students graduate with a grade of "C" or better in all of the major required courses.

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

The discipline has been in continuous demand for trained persons for a significantly long time, centuries in fact. However, given the behaviors seen during the pandemic and the individuals still refusing to get vaccinated, it might call for some more mandated science education for the masses. Given this societal need, possibly the Biochemistry program should design a course to contribute to Illinois State University General Education curriculum to help fix the distrust of science that seems to be growing in the population.

Responses to previous program review recommendations

This is first eight-year program review for Biochemistry, so the program has not had a full response yet. However, the program did get a response to the three-year review. The major recommendation was that Biochemistry develop its own Assessment plan, which the program faculty subsequently did.

Major findings

Overall, the Biochemistry program is performing fairly well, but likely is still riding the inertia from the ten year push it received from the preceding Biochemistry/Molecular Biology program. Given the national popularity of this degree program, it certainly has potential to grow into a vibrant major at Illinois State. Indeed, given the interest it garners from our incoming freshman, with essentially zero recruiting efforts from the department or university, suggests that there is room to grow. Also, even small adjustments to the curriculum or scheduling may pay dividends in retention of these majors, although our graduation rates do appear to be in line with the other Illinois public universities that offer a B.S. in Biochemistry. Thus, it is time for the department and the university to decide whether they want to invest time and energy into this program and bring it to its potential, or whether these students might be better served elsewhere within Illinois State University (e.g., the Molecular and Cellular Biology program) or at another university altogether. Given that the department will be hiring a new chair this year, it is the perfect time to have the discussion so the new leadership can assign assessment and coordinator duties as required for the success of Illinois State Biochemistry.

Initiatives and plans

The Biochemistry program has strengths and weaknesses with potential for future growth. With an influx of funding ($97,000 toward an updated laboratory shared with Physical Chemistry) to provide a new lab with capacity for 20 students, this is a great start toward the major reaching its potential. The three major areas of potential improvement are funding, recruitment of high-quality undergraduates, and targeted hires of new Biochemistry faculty. In the area of funding, the new chair should champion the Biochemistry major to alumni of the department and any other Illinois State alumni in the biomedical field. As discussed elsewhere in this report, one immediate improvement is to correct the inability to reward talented students into Biochemistry with existing departmental scholarships. If this is an overly literal interpretation of these scholarships, then an immediate impact could be felt by using these funds to recruit the best students and allow them to pursue either Chemistry or Biochemistry. In addition, continual fundraising for scholarships for this newer major should be aggressively pursued. The new chair should also assign a small team of faculty to lead recruitment efforts in such a way that all faculty are invited to participate in local high school visits and update recruiting materials to send to high schools around the broader Midwest, perhaps highlighting publications with undergraduate coauthors. Finally, continual evaluation of current research activities in the biochemistry division will lead to strategic hiring of new faculty that complement the strengths of the biochemistry division and thus lead to new and exciting research opportunities for undergraduate students in the major.

PROGRAM REVIEW OUTCOME AND RECOMMENDATIONS FROM THE ACADEMIC PLANNING COMMITTEE

The Department of Chemistry houses four degree programs: a B.S. in Biochemistry, a B.S. in Chemistry, a M.S in Chemistry, and a M.C.E. or M.S.C.E in Chemistry Education. In addition, the department offers a minor in Chemistry. This is the first review of the B.S. in Biochemistry as a stand-alone program. The program provides a solid foundation necessary for advanced study in medicine, veterinary medicine, pharmacy, chemistry and biology, as well as forming the basis for entry-level positions in the pharmaceutical and biotechnical industries.

The Academic Planning Committee recognizes that many of the efforts and activities that led to the development of the self-report were accomplished during the time-period coinciding with the COVID-19 pandemic. The committee thanks program faculty for their critical reflections about the current state of their program.

The self-study reports that enrollment has been relatively stable for the B.S. in Biochemistry program at between 60 and 70 students. However, the self-study notes that recruitment into the program “occurs via happenstance” suggesting that a more targeted plan for recruitment should be developed. While enrollments in the program have

been steady, the self-study report notes that the program often has a significant loss of major from the program relatively low graduation rates and Fall-to-Fall retention rates that have ranged from 35 to 60 percent for first-time-in-college students. This suggests that the program faculty need to examine their program to identify strengths and weaknesses within their supports for student success. Currently areas of strength include faculty support for student involvement in research and participation in the University Honors Program. The committee commends the program for being certified by the American Chemical Society.

While recognizing the B.S. in Biochemistry program has many strengths, the committee is concerned about many aspects regarding the current state of the program and several of these issues that were highlighted in the self-study. The self-study report is candid in its recognition of the need to further evaluate the program in light of these challenges as well as changes in national and disciplinary trends. Therefore, the Academic Planning Committee flags the B.S. in Biochemistry program for further review. The committee requests that the Department of Chemistry take the following actions and submit the following reports based on those actions.

Report 1: Due December 15, 2023
Submit to the Academic Planning Committee via the Office of the Provost.

Develop a new Strategic Plan. The committee asks that the faculty engage in strategic planning discussions and develop a new strategic plan for the program. In addition to standard elements of a strategic plan (e.g., vision, mission, core values, goals, strategies, and tactics), the committee asks that it includes elements to address the areas related to the other follow-up requests. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost.

Develop a plan for recruitment and enrollment growth. The committee supports faculty efforts to explore further expansion of program enrollment. The committee asks the program faculty to develop and implement a plan for student recruitment, including strategies for increasing enrollment by students from racial and ethnic groups traditionally underrepresented in the program and discipline. Some elements of a recruitment plan have already been identified by faculty in the self-study report, including through word-of-mouth, direct marketing through email, and recruitment at professional conferences. The committee endorses these planned recruitment initiatives. The committee asks that the program work with University Marketing and Communications and their college marketing director to pursue marketing methods to attract students who are seeking online programing and consider effective marketing strategies that target students from a variety of demographic groups. The committee ask the program faculty to evaluate the effects of recruitment efforts on enrollment and, in turn, on the ability of the college to provide high-quality education.

Develop a plan for student success and retention. The committee asks the program faculty to develop a plan for student success. The plan should be used to increase transparency and communication around "student success" by defining the program's goals for, assessment of, and actions towards supporting students enrolled in the program. The plan may provide an overarching structure for other plans (e.g., retention, curriculum, alumni engagement). The committee recommends continued periodic review of the program structure and content to remain current with changes in the field and to maintain program retention and graduation rates (including the percentage of graduates completing the program within four years and trying to reduce the numbers of curricular exceptions needed). The committee recommends that the program continue monitoring student retention, particularly of students from traditionally underrepresented groups. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost.

Complete a review and evaluation of the curriculum. The self-study report identifies a number of potential initiatives related to the program curriculum. The committee asks that the program faculty consider these as part of a comprehensive review and evaluation of the curricula across all sequences, and develop a plan for necessary revisions. This should include a review of the course catalog to clearly identify potential hidden pre-requisites and bottleneck courses. We ask that these discussions involve both internal and external stakeholders as well as comparisons with the curricula of programs at comparator institutions. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost.

Develop a comprehensive plan for equity, diversity, and inclusion. The committee asks the program faculty to develop a comprehensive plan to address issues of equity, diversity, and inclusion. We encourage the program to pursue its goals related to further developing a diverse, inclusive, and equitable environment that effectively supports students, faculty, and staff from diverse backgrounds. The committee urges the program to continue refining and implementing their plans for faculty and student recruitment, including strategies for increasing enrollment by students from gender, racial, and ethnic groups traditionally underrepresented in the program and discipline. We recommend that that the program faculty examine ways to infuse diversity, equity, and inclusion into the curriculum. We encourage the program faculty to look to their other programs within the department as well as comparator and aspirational institutions for indicators of enrollment growth impacts on program quality. Accordingly, the committee asks the faculty to engage in discussions of this plan and to summarize the findings of those discussions in a report submitted to the Office of the Provost.

Comparator and aspirational program analyses. The self-study report provides a brief quantitative analysis of comparator institutions, however, no conclusions or actions are made regarding these comparisons. The committee has included analyses of comparator and aspirational programs in the self-study report guidelines to provide faculty with opportunities to consider the niche their program has among its peers and to gather information for program planning. The committee asks the program to revisit these sections of the self-study and address this section through expanded analyses of comparator and aspirational programs, including aspirational programs nationwide, that could help to develop strategies for addressing priority initiatives for the programs. Program faculty may want to keep in mind that successful response to this analysis and interrelated changes could put the program on a footing to gain enrollment from a national rather than only a statewide cohort, if such is desired, given the department's national reputation for excellence. Such enrollments could also enhance the program's goals for diversity and inclusion.

Report 2: Due October 1, 2024
Submit to the Academic Planning Committee via the Office of the Provost.

The Academic Planning Committee asks the Department of Chemistry to submit an update regarding actions that the faculty have taken in continuing to offer the B.S. in Biochemistry program, either in their current forms or in modified forms, or actions faculty have taken to disestablish the programs. The committee asks the department to submit the report to the committee via the Office of the Provost by October 1, 2024.

The report should address:

- Strategic plan
- Recruitment and enrollment growth.
- Student success and retention.
- Equity, Diversity, and Inclusion plan.
- Comparator and aspirational program analyses.
- Changes to the curriculum and impact of these changes.

Based on the status of the program as reported in the October 1, 2024 report, the committee may request additional annual reports by the department until the programs are once again deemed by the committee to be in good standing, unless the programs have otherwise been disestablished. If the committee has not determined the programs to be good standing by June 30, 2025, and the program has not already been disestablished, IBHE may rescind the authority it granted to the University to offer the program and request that the University disestablish the program.