

REVIEW OF THE B.S. IN MOLECULAR AND CELLULAR BIOLOGY

Classification of Instruction Programs (CIP) Code: 26.0406
Cell/Cellular and Molecular Biology

OVERVIEW

The **B.S. in Molecular and Cellular Biology** program at Illinois State University is housed in the School of Biological Sciences within the College of Arts and Sciences. The School of Biological Sciences houses five degree programs: a B.S. in Biological Sciences, a B.S. in Biological Sciences Teacher Education, a B.S. in Molecular and Cellular Biology, M.S. in Biological Sciences, and a Ph.D. in Biological Sciences. In addition, the school offers a minor in Biological Sciences and a Biogeographic Information Systems Graduate certificate. This is the first review of the B.S. in Molecular and Cellular Biology program.

The B.S. in Molecular and Cellular Biology program is designed for students interested in the molecular sciences. Coursework for this degree differs from the Biological Sciences major because it is focused on macromolecules, cells, genetics, and the chemistry of living systems.

Enrollment and Degrees Conferred by Plan of Study, Fall Census Day, 2014-2021

B.S. in Molecular and Cellular Biology, Illinois State University

First Majors Only

	2014	2015	2016	2017	2018	2019	2020	2021
Enrollments	93	125	120	131	111	102	98	91
Degrees	3	9	27	28	38	26	31	33

Table notes: Graduating Fiscal Year consists of summer, fall, and spring terms, in that order. For example, Graduating Fiscal Year 2018 consists of the following terms: summer 2017, fall 2017, and spring 2018.

EXECUTIVE SUMMARY PROGRAM REVIEW SELF-STUDY REPORT

Program goals

- 1) To recruit students with strong academic records
- 2) To promote and support diversity among our students
- 3) To promote a strong conceptual understanding of biology as well as the scientific method
- 4) To promote undergraduate scholarship through research projects under the supervision of a faculty mentor

Student learning outcomes

- Objective 1. Students will understand the fundamental basics of molecular and cell biology by mastering key concepts in genetics, inorganic and organic chemistry, physics, biochemistry, biotechnology, and cell biology.
- Objective 2. Students will develop both written and oral communication skills needed to be an effective scientist.
- Objective 3. Students will develop the ability to formulate questions and adequately design experiments to test them. These problem-solving skills are crucial to the field of molecular and cellular biology.
- Objective 4. Students will develop safe and effective laboratory skills, including those for handling chemicals, using instrumentation, and conducting basic DNA, protein, and cell manipulations.

Program curriculum (2021-2022)

Program review conducted 2021-2022. Report submitted to the Illinois Board of Higher Education, Fall 2022

Graduation requirements:

120 credit hours including 72 credit hours for the degree program and 39 credit hours for General Education. The 72 credit hours for the degree program include 37 credit hours of biology courses, 20 credit hours of chemistry courses, 8 credit hours of mathematics courses, and 8-10 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)

24 tenure track faculty members (8 Professors, 10 Associate Professors, and 6 Assistant Professors)
6 non-tenure track faculty members (1 full-time, 5 part-time, totaling 2.6 FTE)
Undergraduate student to faculty ratio: 29 to 1
Undergraduate student to tenure-line faculty ratio: 32 to 1

Specialized accreditation

There are no plans to pursue specialized accreditation at this time.

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

No changes to the discipline were reported.

Responses to previous program review recommendations

There were no prior recommendations because this is the first program review for the program.

Major findings

The program faculty find that the Molecular and Cellular Biology program has been quite successful in its first 8 years. Molecular and Cellular Biology students are academically successful, and the program has high retention rates with those students leaving the program deciding on a different major here at Illinois State University. In addition, the program has demonstrated the ability to recruit diverse students to the program and have high rates of historically underrepresented students in the program. As many of the Molecular and Cellular Biology faculty are active in the STEM Alliance, NexSTEM, and SACNAS, program faculty are able to support minoritized students and to provide them with research opportunities within program faculty's laboratories. The program has been successful in converting many of the lab courses to Course-based Undergraduate Research Experiences (CUREs), which increases the efficacy of learning among students. In addition, students performing research in program faculty's laboratories have presented their data at local, regional, and national/international meetings and have been authors on published scientific articles. One weakness the program faculty has identified is that the program has insufficient faculty to further expand the program's CURE courses and to provide individualized research experiences for students. Another weakness of the program is a lack of consistent assessment. However, now that the program is under new leadership, the faculty have been developing a plan for assessment using published tools and establishing a timeline.

Initiatives and plans

Moving forward, the program faculty want to continue to improve the Molecular and Cellular Biology program, particularly in the development of practical skills that will make the program's students competitive for both next-level education programs as well as STEM careers. In order to do this, the program faculty propose the following changes.

1) As the program offers two courses that provide students with hands-on training in biologically relevant computer skills, the faculty would like to add these courses to the MCB elective lab options. This will allow students to have more options for laboratory, skills-based classes.

2) The program faculty would like to continue to revamp the Molecular and Cellular Biology lab courses as CUREs and to add additional CURE lab courses. These types of courses have been shown to have a major impact on students. Interestingly, they provide a mechanism by which historically underrepresented students are able to make gains in self-efficacy that match those of students who have had access to more opportunities⁸. In addition, as the program does not have sufficient faculty to meet the demands of individualized research experiences, these types of courses provide an opportunity for us to provide real-world, inquiry-based research experiences to larger number of students. However, one issue with using CUREs in laboratory courses, is that the faculty want to expose students to cutting-edge techniques. These types of experiments are costly, and the lab fees do sufficiently cover the cost. Therefore, the program faculty would like to work with the University to identify means by which faculty can provide meaningful research experiences to students that will make the competitive after graduation.

3) One barrier that prevents students, in particular students from historically underrepresented backgrounds, is that they have to choose between working a job and doing research or gaining clinical experience. One issue is that students graduate with insufficient hands-on experience to be competitive for professional/graduate programs. Therefore, students may take gap years in order to gain this experience and/or save money for tuition. As these experiences are critical to the success of students to be accepted into professional/graduate programs, the program faculty would like to develop a Biological Sciences work study program in which students can work in the laboratory on an independent research project. In addition, faculty would like to develop a partnership with area clinics/hospitals to provide paid internships for students.

4) A major weakness of the program is the lack of a formal assessment of program. The program has identified appropriate published Molecular and Cellular Biology assessments and plan to initiate these assessments starting in Fall 2021.

5) Program faculty would like to set up a system for collections of data at the end of each semester on student outcomes. This way faculty can have easy access to student data, and hopefully get relevant information from students before they leave campus.

6) Faculty would like to develop a better system for obtaining alumni data. As many students take gap years, the program is missing valuable information about what becomes of these students. Program faculty hope that they are going and staying in STEM careers and/or are pursuing the next level of education necessary for their profession.

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 B.S. in Molecular and Cellular Biology program in the School of Biological Sciences to be in Good Standing.

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 the program for a comprehensive and critical self-study report.

The committee notes that the program's enrollments initially from 93 students in 2014 to a high of 131 in 2017 but have since declined to 98 in 2020. The program faculty see an opportunity for controlled growth of the program (with continued student interest and opportunities for graduates) with a target of 100-120. The committee supports faculty efforts to explore further expansion of program enrollment during the next program review cycle. We commend the development and use of the recruitment strategies identified in the self-study report that the program has begun using. The committee commends the program faculty for efforts that have led to high levels of gender and racial/ethnic diversity among its students. The percentage of students identifying as women has remained relatively

constant during the period of review (averaging 58 percent since 2016). The percentage of undergraduate students from groups traditionally underrepresented in the discipline has consistently remained above the University average (ranging between averaging 34.5 percent since 2016). The committee commends the department for their recruitment plan that includes the use of letters and participation in recruitment events (e.g., open houses, Redbird Days, and Presidential, University Scholar days, and science fairs at local high schools).

The committee commends the program faculty for their efforts to support the success of their students. The committee commends the program for aligning their creative and varied co-curricular activities with their program learning objectives and assessment plan. These opportunities provide students with opportunities to participate in activities that allow them to engage with the community, to learn from experts in the field, and network with potential employers. These varied opportunities include in NexSTEM, STEM Alliance, SACNAS, and Women in Technology and Science. The committee commends the program faculty for encouraging majors to participate in the University Honors, resulting in participation rates ranging between 20 and 26 percent. We note that time-to-degree statistics for majors are at or better than institutional levels over the period of review. We commend the program faculty for their support of student research, which has resulted in co-authored publications and local and national conference presentations.

The committee commends the faculty for their ongoing review and revisions to the curriculum during the period of review. This work included the development of a Course-based Undergraduate Research Experiences (CUREs) in a number of courses, the revamping of MSC 260 Microbiology and BSC 350 Molecular Biology to reflect recent gains in microbiology and more advanced techniques, the addition of two new lab courses: BSC 319 Genetics of Behavior and BSC 370A01 Applied Microbiology, and a new BSC 370A03 Programming for Biology course. The committee further commends the program faculty for their support of and participation in the General Education program.

The committee notes that the department faculty have discussed the development of a new assessment tool designed to assess student learning outcomes and have initiated a focus group forum to collect student feedback about the program.

The committee recognizes the faculty members of the program for their scholarly contributions to the B.S. in Molecular and Cellular Biology. Faculty members are active researchers who pursue grant opportunities, publish peer-reviewed journals articles, and present at national and international professional conferences. Additionally, we recognize that every faculty in the program has been activity involved in advising and supporting professional student organizations, demonstrating their commitment to facilitate learning and educational experiences of our students outside the classroom.

Follow-up Reports.

Assessment Plan. The Academic Planning Committee recognizes faculty efforts to develop new tools for assessing student learning objectives and feedback. The committee asks that the program work with University Assessment Services to review and refine the existing plan so that it provides meaningful information to guide faculty in their program revisions and clearly states mechanisms for how that information will be used to inform program revisions. Accordingly, the committee asks faculty to submit a revised assessment plan to the Office of the Provost by August 15, 2023.

Aspirational Programs. 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 would like the program to revisit the aspirational section of the self-study. In a subsequent follow-up report, the committee asks the faculty to address this section through an expanded analysis of aspirational programs, including aspirational programs nationwide; this could help the faculty develop strategies for addressing priority initiatives faculty have identified for the next review. Studying aspirational programs might also help faculty with the exploration of alternate program delivery methods. Accordingly, the committee asks faculty to revisit their discussions of comparator and aspirational institutions and to summarize the findings of those discussions in a report submitted to the Office of the Provost by August 15, 2023.

Recommendations.

The Academic Planning Committee thanks faculty members of the School of Biological Sciences for the opportunity to provide input regarding the B.S. in Molecular and Cellular Biology program at Illinois State University through consideration of the self-study report submitted by faculty. The following committee recommendations to be addressed within the next regularly scheduled review cycle are provided in a spirit of collaboration with department faculty members. In the next program review self-study report, tentatively due October 1, 2030, the committee asks the program to describe actions taken and results achieved for each recommendation.

Develop a plan for controlled enrollment growth. The committee notes that demand for the program remains strong, but enrollments are below target levels. The committee acknowledges the work faculty have completed regarding their recruitment efforts, and that this work has been successful in enrolling both first-time-in-college and external transfer as first and second majors in the program. Given the time and energy that must be devoted to such recruitment activities, the committee suggests that program faculty continue to identify external student populations for recruitment. The committee encourages the program to continue refining and implementing their plan for student recruitment including strategies for increasing enrollment by students from racial and ethnic groups traditionally underrepresented in the program and discipline.

Continue to focus on equity, diversity, and inclusion. The committee recognizes the efforts that have resulted in the diversity of faculty and students within the program. We encourage the program to continue to pursue its goals related to further developing an equitable, diverse, and inclusive environment that effectively supports students, faculty, and staff from diverse backgrounds. We encourage the program to continue refining and implementing their plans for recruiting students from groups who are traditionally underrepresented in the program and discipline. Furthermore, we encourage the program faculty to continue to examine ways to infuse diversity, equity, and inclusion into the curriculum.

Continue to focus on student success and retention. The committee recommends that the program faculty 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 related initiatives (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. The committee recommends that the program continue monitoring student retention, particularly of students from traditionally underrepresented groups.

Continue to review and revise the curriculum. The committee recognizes substantial work by faculty members to review and update the program and its curriculum. The committee recommends continued periodic review of the program structure, including assessing the impact of recent revisions. We suggest that the program explore the potential of developing additional 300-level elective courses. The committee strongly recommends that the faculty continue to explore ways to infuse issues of equity, diversity, and inclusion into the program. We also recommend that the program examine potential opportunities to increase the availability of internships and direct job placements.

Continue the collaborative work with Milner Library. The committee recommends that the program work with the subject liaison librarian to examine and evaluate the library's journals and monograph collection related to molecular and cellular biology to aid in both the selection and deselection process of these sources. Given recent journal cancellations and expected increases in distance and hybrid courses, we encourage the Department and the Library to further collaborate to increase awareness of alternative access to resources, such as Interlibrary Loan and I-Share lending, among faculty and students. We also recommend that the program work with the subject liaison librarian to develop a tiered approach for information fluency learning outcomes for the Department, align those outcomes to the curricula, and integrate those outcomes into the student learning outcomes assessment plan for the program.

Develop a plan for alumni tracking and engagement. The committee encourages the faculty to continue to refine their plan for tracking program alumni and use this system to enhance alumni networking and engagement. These activities may become even more important in the years ahead as the program’s alumni become more diverse. The

Program review conducted 2021-2022. Report submitted to the Illinois Board of Higher Education, Fall 2022

program could benefit from increased involvement of its alumni, employers, and other external stakeholders in providing input regarding the program and in mentoring students and providing employment opportunities for program graduates.