

Academic Program and Curriculum Committee

Review of the Undergraduate Program in Biological Science

Review Team:

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1. Introduction

The review team was assembled in September 2022. The self-study was completed in February 2023 and shared with the review committee on February 27th. The review team used the self-study report as foundation and conducted various meetings in the month of April and May. These included meetings with the Department Chair and Associate Chair, teaching staff, facility manager and staff, office staff, students, and alumni. We also inspected the classrooms and auxiliary facilities.

Recommendation: The program is in good standing and is recommended for continuation.

2. Actions since Previous Review

A. Response to Previous Review

- **Recommended that the faculty be given time and technological assistance to increase online learning opportunities for students.**

The Department responded well to the recommendation to increase online learning opportunities. This process was greatly accelerated by dealing with social distancing during the COVID19 pandemic. Currently all course material is available online using Canvas with included recorded lectures.

- **The faculty of Biological Sciences and the external reviewers describe a lack of ability to access important journals in the biological sciences.**

The UWM library is offering access to all primary literature via interlibrary loans. Although not immediately available, research articles are usually ready for download the next day.

- **The department should develop internal mechanisms to value and reward as part of faculty workloads individual contributions in T.A.-assisted courses, on-line teaching, UROP, and student research supervision.**

Internal reward mechanisms for faculty have not been developed for working with undergraduate teaching assistants and undergraduate researchers. Although important for the academic development of the student, the College of Letters and Science is not recognizing this work as part of the workload model like classroom education. The Department has limited resources (money and faculty) to reward faculty with funds and time for this educational work.

- **Recommend that the department enlist the Biology Club to enhance education of undergraduate students in careers in biology in public and environmental health, biotechnology, and the pharmaceutical industry.**

The Department has enlisted the Biological Science Association to enhance undergraduate student education. The student association has only a few members that need some guidance. The Graduate Organization of Biological Science for graduate students is more active and has organized events than undergraduate students attended.

- **The list of GER courses offered by the department is somewhat diffuse. The GER list needs to be trimmed to include only the fundamental biology classes at an introductory level. The GER science requirement includes a laboratory course, so the pruning of the list should spare sufficient lab courses to avoid producing bottlenecks for students.**

GER reform (reduction) is currently occurring at the College level. GER designation are courses designed to convey the subject matter mostly to non-science students.

- **The Microbiology program urgently requires new faculty hires to replace retired and departed faculty to allow their faculty more time to dedicate to teaching upper-level electives.** Increase of faculty number has not been achieved. Three faculty members left, and more retirements are on the horizon.
- **The Microbiology program should work with the Bio Sci department, L&S, alumni affairs, and other campus entities to improve tracking of graduates.** No mechanism has been developed by the Department to track BioSci alumni. Also, the college of Letters and Science and UWM alumni affairs have not approached the Department to offer support.
- **The Microbiology program should work to increase the visibility of their major and recruit additional students.** Student advising was reorganized to increase the numbers of Biological Science majors.
- **Chemistry 501 (Biochemistry) should be a required course for the major.** CHEM501 was not implemented as a requirement but is an option to BioSci315. Most of the students are taking CHEM501.
- **The Microbiology program should implement an “advising day” for their majors to help guide students and provide a better sense of community among their small cohort.** Open advising days have been implemented and an excellent work sheet is in place to help students to choose the right classes. An advisor is assigned to every student.
- **The Microbiology program should consider revising the major requirements to allow for more upper-level elective credits to allow their students more opportunities to specialize. This could be accomplished by reducing the number of credits required in Physics, Chemistry, or general Bio Sci courses at the discretion of the program faculty.** Reduction of chemistry and physics courses to allow more upper-level course flexibility was not implemented due to the value of teaching basic science knowledge across natural science disciplines.
- **The Microbiology program should offer more specialty courses as electives, and these should cover a range of microbiology topics including virology, mycology, and phycology.** More specialty courses like virology have been added but have limited offering due to the small number of faculty.

1. Opportunities and Challenges

There are several challenges and opportunities that are already outlined under Section A. Opportunities were implemented with a new Neuroscience program in collaboration with the Psychology Department. There has also been a restructuring of students advising. One of the biggest challenges for the Department is student retention and recruitment. Current efforts at the University level do not directly help the Department but rather add additional tasks to an already overburdened faculty. Social media tools as well as the creation of social meeting places within the building should be explored to help students develop camaraderie and a sense of belonging. The undergraduate student organization as well as events specifically for undergraduates should be strongly supported by the Department. This would help shift some of the workload from the faculty to the students. The Department should continue its efforts to better prepare students for professional school, graduate school, and industry. In particular, faculty should be encouraged to offer research opportunities for undergraduates with the support of the College of Letters and Science. Efforts should be made to improve communication with alumni to support fundraising

and overall presence at Department events. Better social media strategies can be developed by the University and offered to the Department without increasing faculty or staff workload.

3. Department/Program Overview

A. Department/Program Mission and Organizational Structure

The mission of the Department of Biological Science is to convey the knowledge of biology that is critically important in many areas of modern life, from the health of humans, animals, and plants (advances in vaccine development and antimicrobial compounds, pathogen surveillance, novel strategies to treat developmental diseases, and novel approaches to sustainably feed humanity, for example) to the health of our planet (bioremediation of toxic wastes, biofuels, strategies to maintain sustainable biodiversity). The Department offers undergraduate programs leading to degrees in the Biological Sciences (BS and BA), in Microbiology (BS), and in Neuroscience (BS). For the degrees in Biological Sciences, three options are available: 1) a B.S. degree in General, Cell and Molecular Biology (CMB); 2) a BS degree in Ecology Evolution and Behavior (EEB); 3) a BA degree in Biological Science which represents a general option for students. In addition, the Department offers a Microbiology program exploring microorganisms (bacteria, protists, fungi, viruses, and others) and their impacts on plants, animals, humans, and the environment. The new Neuroscience program, offered jointly by the Department of Biological Sciences and the Psychology Department focuses on the biology of the brain and behavior.

The department is currently led by Prof. Gyaneshwar Prasad (Chair) supervising the teaching staff, technical staff supporting the instructional laboratories, Facilities Manager, and Department Administrator. The appointed Associate Chair (Prof. Brady) oversees issues related to the undergraduate program. The department has four senior teaching faculty and three staff members to support instructional laboratories. In addition to the facilities manager Jordan Gonnering, Erin Daun and Megan Rose are working as administrators in the Biological Sciences Office. The department also typically supports more than 40 graduate teaching assistants (TAs) each academic year. Rhianna Driebel and Dorothy Kidwell are working as Undergraduate Coordinator together with Prof Brady. This team is very efficient in advising students on coursework, enrollment, course changes, selection of majors and other topics. The team organizes open enrollment days for incoming students and helps more advanced students declare a major. In addition, course advice is available at the Biological Science office.

- B. Facilities and Resources for the undergraduate program consist primarily of teaching laboratories and equipment, with some supporting equipment such as autoclaves and centrifuges housed separately. Our tour of the building found that the introductory teaching labs were well organized and well equipped. Basic equipment was available at lab stations with additional equipment in well-organized storage lockers. Instructors reported a few problems in replacing disposable supplies as needed. This was especially the case for the anatomy and physiology teaching lab which handles a large volume of students every year.

However, there was much concern about the laboratory housing autoclaves used for sterilizing glassware and other re-usable supplies. The autoclaves were very old and not only in need of continued maintenance but at the point where repair parts may soon no longer be available. Similar concerns were voiced about the centrifuges and refrigerators housed in the same lab. A cold room that needed re-wiring before it could be operational was a related concern.

Conclusion. There are not sufficient resources to meet program needs for program stability.

There is adequate space available for the necessary day-to-day operation of teaching labs and the lab staff has dealt creatively with sometime limited resources, but the need to main supporting equipment is a looming problem.

Recommendation(s). It is crucial that the department receives and allocates money for the purchase and upkeep of major equipment items supporting the undergraduate teaching laboratories. This can be achieved by negotiating a one-time investment supported by the College and/or University or by increasing the S&E for consumables. MRI grant applications offer another route to replace larger equipment.

C. Curriculum and Instruction

The Biological Science and Microbiology major requires 120 credits that include 34 credits from the Biological Science curriculum. 26 of these credits must be 300 level and higher. During the first semesters, students are taking general L&S/university requirements in addition to courses in math, chemistry, and physics. All students are required to take BioSci 150 and 152 that have a lab component. This is followed by 300 level “gateway courses” that differentiate majors in CMB, EEB and MICRO. These courses have a lab component as well. For each major specific course requirements exist. CMB includes more organic chemistry and microbiology courses. EEB has additional physics and geological science courses, and MICRO has microbiology, organic chemistry, and biochemistry courses. A general biological science major exists as well. In addition, students can choose from a list of courses that include capstone courses to complete 34 credits.

Overall, the department offers a well-balanced curriculum and students can choose their upper-level classes. This enables students to tailor their education to their interest and aligns with the goal of academic diversity and freedom.

The department has developed an advising system to help students to navigate the program to reduce time to degree completion and overall satisfaction. Each student has an advisor and fills out an advising sheet stating the courses for each semester. This roadmap is simple and enables students to easily navigate the program. The courses have overlapping subject matter to ensure that important principles are learned well and to understand that they can apply to different areas of biological science. Some course sections are relatively small to enable a more personalized experience in the classroom setting. Instruction is offered by faculty, lecturers, and teaching assistants. Some courses are team taught, e.g. BioSci152 that offers lectures on microbiology, plant biology and animal biology. Most classes are based on textbooks and readings for classes are based on specific chapters. Quizzes and assignments are used in almost all courses to encourage students to keep up with the course material. Canvas is used very frequently to offer course material, organized quizzes, and grading. Based on the syllabi provided in the appendix of the self-report, it can be concluded that the structure of each course is diverse and that students should read them very carefully to understand how to maneuver each class.

The higher-level course materials are continually updated to maintain relevance. The diverse Biological Science faculty are constantly accelerating their fields of research and convey

excitement of discovery and provide fresh perspectives on the rules of life, from molecules to behaviors and ecosystems. Independent study courses teach students to perform scientific experiments and work in the laboratory setting. These students are often supported by fellowships from the UWM Office of Research or other national organizations. Regular opportunities to present scientific work and authorship on publications prepare students well for a scientific career in academia and industry. The curriculum also prepares students for professional schools such as medical, dental, and pharmacy schools.

Conclusion. We conclude that the biological science program has a coherent sequence of courses and laboratory sections that offers basic knowledge paired with specialization in the last two years of programs. Educational goals are synchronized with the expectation of professional schools, graduate schools, and industry. The faculty in conjunction with the program offers undergraduate research opportunities that are essential to meet the workforce expectation.

Thus, the program has met both of the following standards:

- i. There is an organized and coherent sequence of coursework that prepares students to meet the educational goals of the program, secure appropriate employment, and pursue graduate study.
- ii. The learning outcome reflects expected workforce competencies.

Recommendation(s).

The recommendation of the review committee is to continue the curriculum and instruction without changes. The committee understands that due to the decrease of the number of faculty some courses cannot be offered by the program anymore. However, the opportunity to enroll in courses offered by other departments will sustain specialization by the program in the future. Individual undergraduate research education should be equally counted as teaching load than classroom courses. They do not only increase retention but also prepare students for a successful academic and industry career arguably more than material conveyed in the classroom.

D. Assessment and Evaluation

- i. An evaluation process that involves students, faculty, graduates, and community members, as appropriate, is in place and the data gathered is used to monitor the program and direct its changes.

Assessment of Standard: this standard is met.

- ii. Relevant credential, if any, achieved within 1 year of graduation.

Assessment of Standard: Not applicable

Courses are evaluated by students using a course evaluation form that is disseminated to students at the end of the semester. The results are shared with the instructor and the chair to encourage changes to the curriculum, teaching and course materials. Faculty performance is also evaluated internally and externally during the promotion process.

An exit survey is in place to evaluate if the program objectives have been met by the students. These include a) Apply Scientific method to biological questions, b) Investigate scientific questions, c) Retrieve scientific information, d) Synthesize, integrate, and communicate scientific information, e) Demonstrate and articulate evolutionary concepts, f) Describe/apply biological information and concepts to society and ethical problems. The trend shows an overall improvement

in students meeting these objectives during the last five years. The microbiology program meets these targets with a 100%.

Conclusion. It can be concluded that the evaluation process for faculty and students is in place.

Recommendation(s). The recommendation of the review committee is to continue the current evaluation procedures for students and faculty.

E. Contribution to General Education

The program significantly contributes to the general education of students. Twelve BioSci courses have GER assignments as NS and NS+. The goals of these courses are for students to acquire basic knowledge in the biological sciences, understand how new discoveries are made, and learn how these discoveries impact our lives. In addition to the subject matter conveyed in the courses and laboratory class, the students learn many soft skills that will improve their lives and careers. The program and faculty are performing outstandingly in this area and the review committee has no further recommendations.

4. Faculty

- i. Faculty and instructional academic staff are qualified and in sufficient numbers to provide quality learning experience.
Assessment of Standard: this standard is met.
- ii. At least 25% of total tenure-tenure track faculty time is committed to the undergraduate program.
Assessment of Standard: this standard is met.

A. Faculty Composition

The faculty is balanced among Cell and Molecular Biology (CMB), Ecology and Evolution and Behavior (EEB), and Microbiology (Micro) specializations. There are 12 men and 8 women with two underrepresented minorities. The rank distribution is two Assistant, eight Associate, eight Full and two Distinguished professors, giving a predominance of senior faculty. Students mentioned that the Biological Science faculty does not reflect the diverse US population and that diversity must be emphasized for future hires.

B. Faculty Numbers and Qualifications

Faculty numbers have declined from 40 to 20 since the last review with several members close to retirement. Yet only three faculty were hired during this period. The qualifications of the faculty are of high caliber and represent the diverse specialization of the program. Faculty numbers should increase to enable a sustainable and future orientated program.

C. Faculty Workload

The workload for all faculty has increased significantly due to:

- a) Time needed to prepare courses that include online accessible material, online grading, answering emails and meeting with students, and additional administrative requirements from newly implemented college and university policies.
- b) reduced faculty numbers with the same workload being distributed among fewer senior faculty.
- c) reduced administrative support for tasks that are now carried out by faculty instead.

Conclusion. The current undergraduate BioSci program with its multiple specializations can only be offered with the help of excellent instructional academic staff. Faculty numbers are at an all-time low and although classroom education can be offered as before, research opportunities for undergraduate students are becoming more limited. From conversation with students, it is evident that undergraduate research is an important tool to retain students by giving them the sensation of belonging, curiosity, and motivation. Adding more instructional academic staff to substitute faculty will reduce research opportunities and overall research output of the Department.

Recommendation(s). The recommendations are to drastically increase the number of faculty and find other means to reduce their workload, especially in the area of course administration. Student teaching assistants can be of great help when used strategically to help faculty with their course challenges and can create a community learning environment that can help to retain students. Students teaching students is a powerful pedagogic concept. University policies should be designed with the goal of reducing the burdens of faculty instead of giving them more tasks.

5. Students

A. Student Numbers and Composition

Standard addressed in this section:

- i. There are adequate numbers of qualified students for meaningful cohorts to meet learning objectives.

While the total number of intended majors has declined by over 50% (536 to 226) in the last 10 years, the number of actual majors has increased by almost 50% (140 to 205) even with a drastic reduction of faculty numbers. Going purely by the numbers, the student experience appears adequate. However, our discussion with undergraduate students (a limited number to be sure) suggested that there are few opportunities for students to interact in non-classroom activities, such as studying for the MCAT or the GRE. This makes departmental support for undergraduate events very important going forward as discussed above in the Challenges and Opportunity section.

B. Student Success

Standards addressed in this section:

- i. There are sufficient resources to meet program needs for assisting students.

The one-year retention has increased during the last ten years and is above 70% for freshman and transfer students. For microbiology students, this number is above 80%, suggesting that there are sufficient resources to meet program needs for assisting students.

On the other hand, student success is usually measured by the number of students with a granted degree. This number has been constant irrespective of the decrease of faculty. The overall 4-year

graduation rate is 30%, and the 6-year graduation rate is 49%, on par with the average for Letters and Science (29% and 46%). Unfortunately, these numbers are worse for minority students (18% and 38%).

- ii. 90% of students complete the program within five years.

Assessment of Standard: this standard is not met. In fact, it is close enough to the UWM average and far enough from standard that the standard appears unrealistic for UWM students, given the competing demands of working and having a social life.

The informal survey for the department showed that 42 out of 63 students have satisfactory employment. This 63% is lower than the 75% standard.

- i. 75% of graduates have satisfactory employment within one year of graduation.

Assessment of Standard: This standard is not met.

Conclusion. Unlike the graduation statistics where the standard itself seems unrealistic, the percentage of students with jobs is within striking distance and might be pulled up with concerted effort.

Recommendation(s). Achieving that 90% of the students complete the program within 5 years could be accomplished by increasing retention. From conversation with faculty and students, reasons to drop out of college can have financial, sociological, and psychological reasons. The department might be able to offer social spaces for students to connect and support social behavior. Financial support can be offered by UWM fellowships that are available but often not noticed by students. A better information strategy should be employed by the university. Psychological reasons, for instance testing anxiety can be accommodated by different testing approaches. Here, the university should offer instructors alternatives. Overall, the reduction of faculty numbers, the increase of workload and administrative burdens work against the abilities of faculty to offer more in person contact hours that will improve retention of students and overall improved their college experience.

As stated earlier in this review we recommend greater contact with alumni as one way of generating knowledge about job possibilities for graduates in the local area. Special attention needs to be given to minority students in this process.

6. Plans for the future.

The program plans are to maintain the undergraduate program (E. Plans). The committee agrees that the program itself has an excellent structure and prepares students well for professional careers. However, for the next self-study a more ambitious future plan should be developed.

The general **recommendations** of the review committee are as follows.

1. To continue the Biological Science Undergraduate Program.
2. Improve the retention of students with the help of the College of Letters and Science, including a strategy for minority students.
3. Recruit at least two faculty over the next 3 years to maintain program quality and student opportunities with a focus on diversity.
4. Increase opportunities for undergraduate students to work with research faculty to improve their skills and preparation for graduate school and industry.
5. Invest in replacement of failing old instrumentation in conjunction with supporting preventive maintenance for laboratories and student-centered facilities.
6. Prioritize continuous evaluation to keep programming focused on professional schools, graduate schools, and industry needs.
7. Track Biological Science alumni and inform about activities ongoing in the department (Newsletter), invite them for events and include them in fundraising efforts.