

Year Three Review Department of Biological Sciences

Academic Program Review of 2017-2018

The Department of Biological Sciences underwent a regularly scheduled Academic Program Review in AY 2018 with the expectation that the Year Three Review would occur in AY 2021. Because of the COVID-19 shutdown, that process was postponed to this academic year.

The Post-APR Action Plan included agreed to by the department, Dean and Provost had many recommendations, which the department addressed individually as detailed below in 2018 at a departmental retreat. The nature of the department response and the status of our continuing response to the recommendations of the external reviewers are detailed below.

Faculty & Research

The external reviewers praised our faculty as “highly collegial and focused on excellence”. They judged the quality and quantity of scientific publication as high “given the constraints of teaching and infrastructure.” They were impressed with the faculty’s tenacious pursuit of funding, but thought that research productivity was constrained the lack of sufficient numbers of graduate students funded by the department. They felt that though the commitment to teaching by the faculty was impressive, the individual teaching load is kept at a level that allows them to maintain research productivity but that the demands of academic advising (currently about 50 students per faculty member) were detrimental.

1. Increase the number of tenure-track faculty.

The external reviewers recognized the very great growth in enrollment in our degree programs, a national trend, that has resulted in a student-faculty ratio far above the UMBC mean and those of competitor departments. They also noted that the department had increased the number and proportion of non-tenure track faculty in the last two decades in response to increased student demands and recommended that the proportion of tenure-track, research-active be increased.

The department agreed with this assessment and has worked with the Dean and Provost to increase tenure-track faculty numbers, with the hiring of six new Assistant Professors since last APR in 2017 and a seventh new hire into the emergent faculty program, who will transition to an Assistant Professor in the Fall of 2022. The hires include three URM faculty, five women and two men. The funds for these hires came through the emergent faculty program, from funding for a new program at the Universities at Shady Grove and from funding for the new Interdisciplinary Life Sciences Program. These hires have gone a long way to reverse the trends noted by the reviewers.

2. Release the department from repayment of outstanding debt .

This item reflects the fact that the current chair inherited a substantial debt caused by deficit spending over many years by the previous chair, which the Dean had required the department to repay. The current chair dealt with the structural deficit in several years and

had paid of all but \$200,000 of the debt by 2017, the remaining debt. This residual debt was the subject of the recommendation.

The department agreed with this assessment and in 2018 the Dean forgave the rest of this debt. Since this time we have maintained a nearly balanced budget and repaid any debts that accrued during each fiscal year from available department funds.

3. Develop a department hiring plan to ensure a regular flow of new faculty; at the institutional level develop a plan for larger startup packages and reduce expectations for departmental contribution to startup.

In the laboratory sciences, a competitive startup package is a crucial issue in recruiting excellent faculty. These packages at elite universities have grown to multiple millions while our department had provided packages in the range of about \$300,000-\$500,000. Most of the recent hires involved packages significantly above this range and we were able to attract excellent candidates. The issue for our new hires is competitiveness. Their direct competitors at R1 universities generally have sufficient startup funds to hire a group of postdoctoral fellows who can essentially immediately produce research results necessary for obtaining external research funding. Our startup packages do provide sufficient funds to allow the outfitting of a research laboratory but not to recruit research personnel. As a result, research progress is usually much slower for our hires, resulting in delays in their obtaining funding. The result is that they start off far behind peers and that situation can persist during the early years of their career. In the future, UMBC should recognize this issue and make changes that would place new hires in a more competitive situation.

Hiring continues to be limited by university losses due to COVID-19. It is unclear when regular hires could return. As part of the COVID response, the department was asked to give up two faculty lines. Because all lines granted to the department are occupied, the next two lines that become available by retirement or resignation will be lost. We hope to regain momentum to continue tenure track hires in the future.

4. The Department Chair should provide faculty with timely feedback and provide a paper trail concerning their meeting expected performance measures.

This issue came up both in the APR and as part of the reappointment of the Chair in 2017. In response to these requests, the chair created a process for all faculty, tenure and non-tenure track, to reflect on their performance in the previous year and their short and long-term plans for development. The Chair reads these reports and then meets with faculty individually to discuss the self-study. A large majority of faculty, but certainly not all, participate each year and the feedback during the meetings has been very positive.

Graduate Program

The external reviewers recognized the “notable strength” of our graduate program in generating high quality graduates who had a high rate of publication and went on to postdoctoral positions at high-quality institutions. However, they did see problems that needed to be addressed. In general terms, the external reviewers felt that the graduate program is too small for the size of the department, and that there are too few students supported on research grants or fellowships and

therefore too many on teaching assistantships, which diminishes the quality of their training and of the research they produce. They made several specific suggestions for improvement of the graduate program.

5. Increase graduate student training by increasing graduate support on grants and by providing a mechanism to encourage submission of graduate student fellowships.

The department agrees with the spirit of this recommendation but not with the means to achieve it. The suggestion that we increase graduate support on grants runs counter to a trend in diminishing availability of Federal research funding in terms of real dollars. The success rate for investigator initiated awards has drastically dropped since the mid-2000s, and in reaction the number of grant requests submitted has grown enormously. UMBC in general has struggled to maintain competitiveness during this period. There is no quick fix for this problem despite our intense desire to achieve a solution.

We welcomed the recommendation to encourage applications for graduate fellowships. The department has institutionalized this as part of the first-year training because eligibility for most of the programs is limited to before the end of the second year of training. About three students per year are now applying for NSF graduate fellowships as well as those to non-governmental sources. These grants are all extremely competitive and we have yet to have notable success but we are continuing the process of encouragement and training.

The external reviewers had several specific suggestions, most of which we felt were either self-defeating or difficult to achieve under our current situation.

(1) The reviewers recommended that all research grant applications include funding for student summer salaries. The reality is that funded grants in the department are insufficient to have a major effect with funding from many sources being too small to allow this type of support. Where larger grants are awarded, the department strongly encourages support for graduate students to increase the efficiency of their training and the quality of their research, and to help reduce their time to completion.

(2) They recommend that the department reduce the guarantee of TA support from two to one per laboratory to encourage the students into funded laboratories. The reviewers suggested that one student would be sufficient for collection of preliminary data for grant submission. The department felt that labs with fewer than two students become unsustainable, lose institutional knowledge of the system, and result in episodes during which no student is available, all of which are destructive of continued laboratory success.

(3) They recommended “using TAs more efficiently” by allowing only one per laboratory section instead of our norm of two. We rejected this suggestion because our experience is that team teaching in this way allows training of inexperienced TAs by their peers and that in classes of 24 undergraduates two TAs are better able to assist all students during the class.

6. Establish a first-year course sequence that emphasizes graduate student professional development.

We accepted this suggestion and created a course BIOL 700 Introduction to Graduate Experience, that provides a grounding in graduate study as suggested by the reviewers.

7. Establish formal graduate level courses in each discipline area or encourage enrollment in other UMBC departments or at neighboring institutions.

This suggestion was made in response to graduate students expressing an interest in having courses not cross-listed with undergraduates. The department is willing to provide exclusively graduate courses, but the faculty feels that, given the diversity of research interests among the students, providing discipline specific courses may be unworkable. The BIOL 700 course discussed above is an example of a exclusively graduate course and we continue to present 3 credit 7XX graduate seminar courses in a variety of disciplines. However, for the present, we plan to continue to have mixed senior undergraduate/graduate courses that are foundational for graduate training.

8. Develop a greater culture of student research presentations.

The department has for decades had a student-organized system of routine research presentations by students to their peers. This supplements the required journal club courses that students must participate in each semester. In response to this suggestion, we now require formal research presentations in the students fifth year that are attended faculty and students. These have been very successful in helping students to focus on finishing their degrees in a timely manner and honing their presentation skills.

Undergraduate Program

The reviewers praised our work to maintain high-quality undergraduate degree programs despite the large expansion in enrollment, which continues from a beginning in the late 1990s, which has resulted in the current very high student-to-faculty ratio for all of CNMS and currently about double that of the other two colleges. They praised our dedication to evidence-based active learning methods, and the involvement of research active faculty introductory classes. They noted, however, that diminished research funding and reductions in numbers of graduate students to serve as mentors has reduced the opportunity for mentored undergraduate research but recognized our attempts to increase course-based research experiences to expand the research experience as widely as possible under the circumstances. They had several specific suggestions to improve the undergraduate experience, including addressing the problem of aging undergraduate laboratories and the stress on faculty of an increasing load of individual academic advising.

9. Increase the number of faculty to bring student-to-faculty ratios in line with other departments.

The problem of the high student-to-faculty ratio resulting from a great increase in enrollment without equivalent increases in faculty staffing was another indication to the external reviewers of the need to add faculty. The standard undergraduate experience in our program involves very large classes (250-325 students) for the first two years, and laboratory courses mainly staffed by non-tenure track faculty and graduate students. We have data from the STEM BUILD program suggesting that student sense of science self-efficacy and science identity decreases during these years. We suspect that the nature of the educational experience in the BIOL and associated programs (MATH/STAT, CHEM and PHYS) is a contributing factor to these losses and that the only true way to address the problem is to work toward lower class sizes by increasing the size of the faculty.

The recent hiring of seven new Assistant Professors (one of whom is expected transition to that status from the pre-professoriate in the Fall) has started to ameliorate the issue of student-to-faculty ratio but, especially with expected faculty retirements in the next few years that will not be replaced because of COVID recession of faculty lines, the problem is expected to persist into the future.

10. *Because teaching laboratories have outdated equipment, which constrains student's learning, increase student lab fees to cover recurring expenses, repair and replacement of equipment and addition, a one-time institutional investment is needed to update lab equipment.*

The reviewer's view was that our teaching laboratories are "below the standards expected for a modern research institution." We agree. None of the labs have been renovated for nearly 40 years and most of them since the school opened in 1966. We were planning to increase the lab fees to more nearly cover actual costs of running the laboratories, but the larger issue of lack laboratories that fall below expected standards is something that must be addressed by renovation of those parts of our buildings that haven't been recently renovated, which includes the basement of the Biological Sciences building and the entirety of the adjoining Schwartz Hall, built in the early to mid-1980s.

11. *Hire professional advisors to substantially reduce the advising burden.*

All faculty—tenure and non-tenure track—advise up to 50 undergraduates or more. This level was necessitated by the increased undergraduate population. The Dean of CNMS has hired professional advisors over the last several years to mitigate the effect on our faculty. We would support more hires.

12. *Assess the effects of the 2010 curriculum redesign on undergraduate outcomes.*

We are in the process of assessing the effects of the redesign. Unfortunately, assessment of our curriculum before 2010 was not done, so we have no baseline to compare to. We will do our best to determine the effectiveness of the new curriculum including where possible, as the reviewers state, determining student success and career satisfaction. We have, however, since the 2100s, conducted program level assessment of learning by our undergraduates and will also use those data to assess the effectiveness of the redesign.

Facilities & Infrastructure

13. *Formalize ILSB occupation.*

At the time of the review in 2017, the occupation of the new ILSB was imminent and there was a significant concern with the plans for how it would be used. The department was concerned with the "hoteling" model that had been floated and expressed that concern to the reviewers. They recommended that the plans for that occupation be made clear. The building has been occupied for over two years and this issue is now moot.

14. *Make renovation of Schwartz Hall an institutional priority.*

The concern for the appropriateness of the current department facilities, noted above, led the reviewers to recommend that UMBC prioritize renovation of Schwartz Hall. It is true that there are signs of system failure in the building with issues of runoff during heavy rains,

which has been successfully dealt with, structural integrity, which became an issue soon after the building was occupied and has also been dealt with, and more recent failures in plumbing and other systems. The impression is of a building that is aging rapidly. The building is in the queue for renovation and, if these signs of aging worsen, we would expect UMBC to move to prioritize renovation.

15. *Ensure that post-award staff in the Office of Sponsored Programs are sufficient in number and adequately trained.*

This recommendation arose from concerns expressed to the reviewers about the movement of support staff to the college shared services center. The concern was with post-award management, which the reviewers stated was “an area that requires further change.” The reviewers didn’t substantiate this claim and the department is unclear about the source of this impression. We do not feel that the claim has clear support and we are happy with current post-award support. However, the college has experienced loss of staff in the shared services center and the staff members working in this area are overburdened currently. We urge a quick solution to this issue. We note, however, that the Dean is actively working to solve the problem.

Response to Department Proposed Future Directions.

The department included six questions to the reviewers about possible plans for future directions. The reviewers provided four responses to these questions.

16. *Expanding discovery-based laboratory courses.*

The reviewers felt that these research intensive courses were costly in terms of faculty time and lab costs and recommended “careful resource analysis” to determine the feasibility of the plan. The department felt that we have taken these issues into consideration and will continue to in the future. We note that the “Phage Hunters” investigative version of BIOL 302L is arguably our most popular course so student demand is obvious. The major obstacle to implementing these courses is availability of faculty, usually non-tenure track, and graduate students to teach the courses. We continue to work diligently to optimize use of both types of instructors for these and other courses.

17. *Formalization of undergraduate and graduate TA training.*

The department proposed supplementing existing undergraduate TA training (BIOL 396 Undergraduate Teaching Assistantship) with explicit and formal training of graduate students (BIO 496/696), which would provide an department-wide graduate TA training in pedagogical concepts, class management, ethics and other topics. The reviewers supported this idea in concept but had several questions about its implementation. Would it be taught every semester? Would training faculty be tenure or non-tenure track? Who will train and mentor the senior graduate students tasked with part of the training? Will the course be redundant with FDC programs. The department, in considering the response, felt that the proposed course was arguably too comprehensive to be routinely implemented, too costly in faculty and graduate student time, and too redundant with FDC programs. We have decided not to continue with this initiative and instead work to increase graduate attendance at relevant FDC programs.

18. *Expanding the training program for undergraduate TAs and establishing a Center for Training in Biology Education.*

Although the reviewers supported this idea, the department has subsequently decided that such a center would be redundant with the FDC and have abandoned this idea.

19. *Establishing research centers focusing on biology research.*

The reviewers supported this idea, which was envisioned as part of our effort to improve competitiveness for federal grants. The department suggested the creation of research centers to improve collaboration among faculty and students in defined research areas. Two ideas had wide support: an Interdisciplinary Consortium for Applied Research in Ecology & Evolution (ICARE), and a Center for Biomolecular Innovation, Technology and Entrepreneurship (BITE). The latter lost momentum because it was seen as too diffuse. The former progressed to an NSF-funded center occupying space in the ILSB and uniting faculty across all three colleges. The department remains in favor of forming such centers but struggles with the diversity of research interests among faculty. Informal arrangements have persisted, the most successful involving the community of interest in developmental biology, who have organized to share insights in approaches to that type of research. No large scale plans are in progress at present.

20. *Improving graduate training.*

The department proposed improving graduate training to directly address the national trend toward graduate students having career plans outside of academia or formal scientific research. An approach to this issue is to encourage/require graduate students to create individual development plans (IDPs). The reviewers favored this idea. The department has offered voluntary IDP workshops over the past three years with about 10 students participating per year. We have also had voluntary workshops on CV preparation (twice), figure preparation (once), preliminary examination preparation (yearly), peer reviewing (once) and preparation of NSF fellowship applications (twice, offered by CNMS). We also had a six-week writing workshop in the summer of 2018 to pilot this type of training in the department with five students participating. In 2020, graduate students organized a writing accountability group that met online during COVID. We believe these efforts to be positive but, especially during COVID, it has been difficult to generate sufficient interest among graduate students to expand them past these events.

The second suggestion to improve graduate training was the idea of courses in the first year of study to teach “common” techniques used in biological research in Fall semester mini-courses. The reviewers were not enthusiastic believing that the breadth and diversity of research in the department made the idea of “common” techniques implausible. The department agreed with this conclusion.