

## BIOLOGY PROGRAM REVIEW ACTION PLAN

23 December 2014

### **Background and History**

The Biology Academic Program Review (Biology APR) was initiated in the Fall of 2012 with a request from Academic Programs to initiate the process. Data were collected over the rest of that academic year culminating in a 77-page Self-Study Report that was presented to Academic Programs in the spring of 2013. A review panel was convened consisting of 3 external reviewers and 4 internal reviewers. The panel visited on June 5-6, 2013. The Chair of Biology received the Review Panel's initial report on 7 November 2013 for fact checking. On 4 March 2014, Academic Programs sent the final report to the Curriculum Council. The Chair of Biology met with the Curriculum Council on 10 April 2014 to answer questions about the report. The Curriculum Council provided the Biology Academic Program Review Evaluation Report (Biology APRER) on 21 April 2014. This Action Plan provides a response to the Biology APRER and plans for improving the quality of the program.

### **Summary of Findings and Recommendations/Proposed Actions**

The Biology APRER had 6 findings/recommendations that are addressed below.

1. *“The program relies on the energy and collaboration of multiple academic units drawn from diverse administrative units of the University. Continued success of the program will depend on the installation of scalable leadership, administrative mechanisms to sustain the commitment and collaborations of participating academic units, and an equitable plan for resource distribution.”*

The Biology Program ceased operation as an administrative unit in Winter quarter 2014 with the formation of the School of Life Sciences (SOLS) and the merger of the Biology Program and the Zoology Department into the new Department of Integrative Biology (IB). The Biology major has been maintained and indeed, has grown to 918 majors since this report was issued. The IB department has a department Head, and an Associate Head and Director of Undergraduate Programs to oversee undergraduate curricular matters for both the Biology and Zoology majors. There is an IB Curriculum Committee that oversees all curricular matters for both the Biology and Zoology majors. In addition, there is a SOLS Curriculum Committee, with 2 representatives each from the Departments of Botany and Plant Pathology, Integrative Biology, Microbiology, and Biochemistry and Biophysics. Finally, there is a reinvigorated College of Science (COS) Curriculum Committee with representation from every department in the College. Resource distribution related to delivery of the Biology major is stipulated in an MOU between the Departments of Integrative Biology and Botany and Plant Pathology that is endorsed by the Deans of Science and Agriculture as well as the Provost.

2. *“University enrollment is growing rapidly and program enrollment is accelerating. To retain the current accessible nature of the program (and avoid the need to adopt a professional school filtering model), it will be vital to ensure that institutional resources are invested to cover the costs associated with increased enrollments.”*

To date, the institutional resources needed to run the Biology major have been forthcoming through extensive dialogue between the Head of IB and the Dean of Science. Some of these resources are in the form of Access dollars to open more seats in Biology courses.

Significant investments of resources have been provided by the Dean of Science to hire instructional faculty, especially in the design and delivery of a proposed new on-campus and E-campus Introductory Biology series (BI 20x). Associated with this plan is the need for new teaching laboratory spaces. The Dean of Science has committed to two years of funding to renovate an appropriate laboratory space for the BI 20x series in Weniger Hall. The level of commitment will ensure that this proposed laboratory facility will be just as impressive as the current modernized laboratory spaces for the BI 10x series and the BI 21x series.

Funding for GTA support is an ongoing discussion and all units across campus are struggling to meet the needs associated with increased undergraduate majors needing access to courses balanced against increasing costs associated with changes to support for graduate teaching assistants. The Head of IB and the Dean of Science are well aware of these challenges and are in constant communication in that regard. Another area of longer term concern is the issue of access to our 300- and 400-level courses. With the rapidly increasing enrollment in our service courses in general, and our major in particular, our upper-division courses are becoming over-subscribed (defined as  $n=150$  or greater). This is a challenge in terms of FTE to teach the courses, GTAs to teach the laboratory sections, and physical laboratory spaces in which to offer the courses. This is a university-wide problem, but we are struggling with solutions.

3. *“It is commendable that the program actively promotes experiential learning opportunities and placement of students in research experiences, study abroad, and other high impact learning environments. These opportunities are a defining feature of the program and should be maintained and expanded proportionately with enrollment growth.”*

The Biology major remains the campus leader in the number of students who study abroad and those seeking the prestigious International Degree. International Programs works closely with advisors and administration in Biology in promoting not only our students studying abroad or participating in IE3 internship programs, but also hosting students from abroad to study here at OSU. That effort has only increased since this report was issued. In addition, we have expanded experiential opportunities through curricular changes adopted just this academic year. Now all students completing the Marine Biology Option in Biology are

required to take course work at Hatfield Marine Science Center (HMSC). This insures that all students pursuing the largest option in Biology have an experiential learning opportunity in marine biology at our marine science center. Other curricular changes recently adopted allow for undergraduate research experiences to fulfill Biology degree requirements. Currently, more than half of Biology students responding in the senior exit survey report completion of either an undergraduate research or internship experience. These numbers continue to grow. Finally, in our proposed curriculum revisions to the major, the number of laboratory requirements has increased. And in our Options, we have increased the number of required laboratory courses or experiential learning. For example, all students in the Marine Biology Option are now required to take at least one course at Hatfield Marine Science Center.

4. *“Efforts should be made to ensure that the curriculum, including entry level and upper division courses, features ample opportunities for students to engage in learning activities that demand critical thinking, problem solving and communication skills that go beyond the basic domain of memorization. Pedagogical strategies and assessments that enable rich intellectual engagement should receive increased emphasis even in the context of high enrollment courses.”*

Biology is justifiably proud of our efforts in this area and the Biology APRER recognizes these efforts in its report. Since the Review Team’s visit, the IB department has made even more progress in this area. The major has now been changed so that all students are now required to choose their Bacc Core communications courses and writing courses from a proscribed list of courses more tailored to the needs of our students. In addition, we have developed 3 new WIC courses, reinvigorated another existing WIC course, and are redesigning another laboratory course to be a WIC course. In other changes in this regard, currently four of our upper division courses now include poster presentations by student groups. These directly foster deeper intellectual engagement by the students and they have been well received by our students. These changes are meant to support our efforts at increasing experiential learning.

Significant curricular changes incorporating active learning and critical thinking skills have been undertaken in both the non-majors introductory biology (BI 10x) series as well as the majors introductory biology (BI 21x series). Due to our analysis of course outcomes and assessment of these two series in connection with the conduct of the self-study, IB has proposed and is in the process of designing and implementing a third introductory biology series (BI 20x) aimed at applied science majors. Our analyses revealed that students from these majors were struggling in the BI 21x series, yet students from life science and other STEM majors were not. In addition, faculty from these applied majors were clamoring for the offering of an E-campus version of introductory biology. The IB faculty debated this

issue at length and agreed that this would be a challenging but worthwhile endeavor. The Department of Botany and Plant Pathology endorsed this plan and has been involved in both the planning of the curriculum and in the eventual delivery of both the on-campus and E-campus versions of the new series. This plan has also been endorsed by both the SOLS Curriculum Committee as well as the COS Curriculum Committee. The course proposals have now been endorsed by all the Colleges and is awaiting discussion by the Bacc Core Committee this winter quarter. We believe that this new series will better serve the breadth of majors and students on this campus. We will be monitoring the success of all three of these introductory biology series. We predict that the DFW rate will continue to fall in the BI 21x series as has been the trend for the past several years.

Innovative pedagogical strategies are currently underway in other courses in IB. These include extensive active learning strategies, analysis of graphical data, and efforts to increase critical thinking in BI 371 Vertebrate Biology which is taking on more of a role as a capstone course. Z 425 Developmental Biology has also been extensively reworked to increase the experiential laboratory component as well as experimental design, data interpretation, and critical thinking. One of the most extensive changes made since the Biology APRER was issued is the complete overhaul of the second largest biology series in IB. Anatomy & Physiology until this year was a 3 course, year-long lecture and laboratory series serving more than 600 students each quarter. Again, due to our analysis of the student success in the course, we proposed the splitting of the course into a lower division BI 23x/24x Anatomy & Physiology year-long series for those students and majors with no biology or chemistry background. BI 33x/34x Advanced Anatomy & Physiology is a year-long series for those students and majors that do require a year of both introductory biology and inorganic chemistry. These series provide their students with tutoring through the Academic Success Center SI Tables. However, the most innovative pedagogical changes have occurred in the BI 33x series through the introduction this year of an undergraduate Learning Assistant (LA) program. There are currently 25 undergraduate LA's that receive weekly instruction in pedagogical techniques and strategies who then attend the lecture classes each day. On Friday of each week, the instructor has turned that class period over to a Process Oriented Guided Inquiry Learning (POGIL) format. Each Friday the learning assistants work with the student groups in the lecture course on the POGIL assignments. The instructor is collecting data on the effectiveness of these innovative strategies and has already presented the preliminary findings not only on campus, but has been invited to national science education conferences to share her findings. We will continue to monitor and assess these innovations for reporting annually and in year 3 of the review cycle.

5. *“The program features an innovative and highly worthwhile Graduate Teaching Assistant (GTA) training program, and does an excellent job of assessing and*

*documenting the effectiveness of this program. GTA training serves as a campus model and deserves to be sustained as well as emulated elsewhere.”*

We are justifiably proud of our GTA training program and continue to collect data on the effectiveness of this program not only in training our graduate students as current and future instructors, but also the impact on the undergraduate students. This program has now been expanded to our second largest course offering with the next largest contingent of graduate teaching assistants, the two Anatomy & Physiology series (BI 24x and BI 34x). This work is being supported by IB’s participation in a large, collaborative NSF-funded WIDER ESTEME grant to OSU. It is too early to assess its success, but we are collecting data and will be reflecting on the results of those assessments. The OSU Graduate Certificate in College and University Teaching that initiated in the Biology Program is now a campus-wide program run out of the Graduate School. This certificate program is so popular that it is now being offered on-line and on-campus and there are still waiting lists of students wanting to participate. This has been an extremely successful innovation that we in IB are happy to have played, and continue to play a central role in delivering.

6. *“Continued success of the program will depend directly on the installation of a collaborative curricular oversight body that actively leads the program. This body must ensure diversity of perspective across the life sciences engage all contributing units to sustain in the quality of the program.”*

The Biology Program and major has changed significantly since the Biology APR. At that time, the Biology Program and major didn’t really have a continuously functioning curriculum committee. It could better be described as *ad hoc*. With the formation of the SOLS and the merger of the Biology Program with the Zoology Department into the new Department of Integrative Biology, the Biology major now has 3 curriculum committees that deliberates and oversees the curriculum. The first committee is the Curriculum Committee of the Department of Integrative Biology. That committee oversees and coordinates the curriculum in both the Biology and Zoology majors. After decisions are made in that committee, any changes are next deliberated by the SOLS Curriculum Committee. With oversight and equal participation from the Departments of Integrative Biology, Microbiology, Biochemistry and Biophysics, and Botany and Plant Pathology, this committee does indeed *“ensure diversity of perspective across the life sciences”* in all things related to the delivery of the Biology curriculum. Finally, the College of Science Curriculum Committee also deliberates on any changes to the Biology curriculum and approval from that committee is required for any curricular changes to occur. Thus, the Biology major is now overseen by 3 independent curriculum committees.

## **Programmatic Assessment**

The Biology major will continue to use both direct and indirect assessment of the outcomes for our majors. Indirect assessment is acquired through a senior exit survey. The OSU Survey Research Center works with us to make our survey questions robust and amenable to statistical analysis and validity. All graduating seniors are invited to respond and to date has had a 42% participation rate which is considered high given there are no incentives to participate. Direct assessment will continue to be gathered through metrics/performance on the Educational Testing Service, Major Field Test in Biology. Both of these forms of assessment have been utilized for the past 6 years and they provide a wealth of data on not only the performance of our students, but how well our curriculum provides a meaningful biological education as compared annually to over 45,000 Biology graduates nationwide. The data from both of these forms of assessment provide ample information for the IB faculty to reflect and these conversations do indeed impact our deliberations in the 3 curriculum committees.

One last significant curricular change has occurred but only after the review team visited the campus. The Department of Integrative Biology has now instituted a policy requiring a C- or better in the BI 211, 212 and 213 Principles of Biology series prerequisites before continuing on to 300 and 400 level Biology and Zoology courses in either the Zoology or Biology majors. We believe that this will impact our 6-year graduation rate in both the Zoology and Biology majors as students that experience academic difficulties will take corrective actions sooner in their academic careers. We will be monitoring the impacts of this change and will of course act accordingly if future amendments or significant changes are mandated.