University of Arkansas
Department of Biological Sciences
Undergraduate Program Assessment (BIOL BA, BIOL BS)
Report: Academic Year 2016-2017

Prepared by: David S. McNabb, Chair BISC, dmcnabb@uark.edu

A. General Background:

The Department of Biological Sciences has developed an assessment plan with a two-phased evaluation. Recognizing that combined BIOL-BA and BIOL-BS programs constitute about 1250 majors and approximately 300 graduating seniors per academic year, sub-sampling our students seems the most effective way to assess our program success. Phase I assessment utilizes a sub-sample of 20 to 25% of our graduating seniors who are pre-medical students that take the MCAT. National MCAT scores are published, and thus provide a benchmark to judge the efficacy of our program. Phase II of our assessment is to evaluate our General Education courses and will involve comparisons of pre- and post- test scores for a standardized test administered at the start of each semester, and again after completion of the General Education course. The paragraphs below provide our data for Phase I and Phase II based on our first year of reporting. In future reports, we will provide cumulative data to establish longitudinal assessment data for our program.

B. Outcome Reporting:

Program Goals:

1. Foster the scientific curiosity of students about biological sciences.

2. Communicate the current state of knowledge and technology to students.

3. Nurture critical thinking, reasoning, and problem-solving abilities.

4. Enhance students' communication skills for communicating scientific ideas.

5. Prepare students to achieve academic and professional success.

Student Learning Outcomes:
The following learning outcomes mirror those proposed in several recent reviews of biology pedagogy. They apply to the both the introductory biology course and to completion of the department's common core of courses, cell biology, genetics, evolutionary biology, and ecology.

1. Show that you can understand data that support the hypothesis that all organisms are genealogically related including the recognition that all organisms are cellular and that they share the same basic genetic system.
2. Show that you can understand data that support the hypothesis that all organisms need energy and a source of building blocks to maintain themselves, grow, and reproduce.
3. Show that you can understand data that support the hypothesis that all organisms use information to maintain themselves, grow, and reproduce, and that that information can both be stored genetically and be received from the environment.
4. Show that you can understand data that support the hypothesis that all organisms interact both with other organisms and with the physical components of their environment and that these interactions affect their ability to maintain themselves, grow, and reproduce.
5. Show that you can distinguish data-supported interpretations of biological systems from anecdotal information.
6. Show that you can understand and use quantitative methods for explaining how biological systems work. This will include graph interpretation, table interpretation, and basic mathematical formulas.
7. Show that you can apply the information that has been presented during the course to novel situations.

Phase I - Subsampling with the MCAT:

Biological Sciences graduates approximately 300 students in the BA and BS programs per year. A large number (~50-70) of these students are declared premedical students and all take the MCAT as an entry-level test for Medical School aptitude. The department has access to summary statistics for our students that take the MCAT. Moreover, statistical summaries that describe MCAT test results nationally are published. The scoring for the MCAT changed in April 2015, so our assessment only includes scores based on the new scoring strategy. Importantly, the combined scores on the MCAT range from 472 to 528 with the mean and median at 500. This provides a convenient mechanism by which to evaluate our UA Biology students with other individuals nationwide that took the same exam. Table 1 shows the data for MCAT scores from 2015 to 2017.

Table 1: MCAT scores for Biology Majors 2015-2017

YEAR	# BIOL Students	BIOL Majors Average	U of A Average	BIOL U.S.*	Overall U.S.*
2015	57	502	501.1	*NA*	*NA*
2016	71	501.8	502.6	501.6	501.8
2017	30	501.5	504.1	*NA*	*NA*

* NA: not available

While we only have the national average for 2016 (due to first calendar year of the new MCAT exam), BISC majors (BS and BA combined) performed similarly to the national average in that year. We take this as a positive sign that our educational program is comparable to the average results achieved by all programs nationwide.   We are encouraged by these results; however, we strive for improvement. Since the new MCAT is heavily focused on critical reasoning skills, our curriculum improvement in this area should facilitate improved scores in the future.   We note that in this current form, the data do not differentiate between Biology BA and BS students. However, for the time being, since the BA and BS degrees share many of the same courses and the biology core, we take the current combined program data to represent performance of both degree programs.

Phase II: Pre- and Post- testing of BISC General Education core courses.
Phase II of BISC's program assessment plan requires administration of pre- and post- tests for the general education courses offered by the department. These courses will include: BIOL1543/1541L (Principles of Biology), BIOL1584 (Biology for Majors), BIOL1603/BIOL1601L (Principles of Zoology), BIOL1613/1611L (Plant Biology), BIOL2213/BIOL2211L (Human Physiology), and BIOL2443/2441L (Human Anatomy). The pre- and post-assessment exams were developed by the faculty in Biological Sciences and they are on record with the Fulbright Dean's office. Below are the pre- and post-assessment scores that were initiated in Spring 2017.

1. **BIOL1543/1541L (Principles of Biology):** Principles of Biology is a university core general education course that is designed for non-biology majors. During the first week of classes in the Spring 2017, a pre-assessment exam was administered with the same exam subsequently given at the end of the semester. There were 542 students that completed BIOL1543, and 509 of those students took the pre-assessment exam with an average score of 43%. There were 478 of the same cohort that completed the post-assessment test with an average score of 61%; hence, we observed a 18% increase in the average score indicating that students are certainly improving. In the Fall 2017, the instructor is implementing more active learning experiences in an effort to engage the students in class and to enhance attendance. Our assessment in 2017-2018 will provide data addressing whether the new strategy enhances learning the material. We will maintain longitudinal data sets to identify trends and changes over time.

2. **BIOL1584 (Biology for Majors):** Biology for Majors is a newly developed course offered by Biological Sciences to provide an enhanced introductory freshman biology experience that would be applicable for science majors. The Spring 2017 semester was the first pre- and post-assessment evaluation of the course. There were 193 of the 199 students enrolled in BIOL1584 that completed the pre-assessment exam with an average class

score of 55.8%. There were 184 members of the same cohort that completed the post-assessment test with an average score of 57.8%; a modest, and statistically insignificant improvement. While the lack of improvement in student learning outcomes is a concern that will be monitored by the Department Chair, there are two caveats to these data. First, this is a new course (initiated Fall 2016) with the lectures and pedagogical strategies under development. Second, the faculty member that was actively involved in the development and delivery of this course as well as the assessment exam was on OCDA in Spring 2017, so the implementation of the curriculum was interrupted by a replacement faculty member. Considering the sequence of events, I would hesitate to make any changes to the course until we have additional data for AY2017-2018. If the pre- versus post-assessment exams do not show a significant improvement, then we will need to reevaluate the pedagogical approaches being implemented. We will maintain longitudinal data sets to identify trends and changes over time.

3. **BIOL1603/BIOL1601L (Principles of Zoology):** BIOL1603 is only offered in the Fall semester of each academic year; hence, the first assessment will occur with AY2017-2018. In Fall 2017, the pre-assessment exam has been administered and it will be given again at the end of the term. We will maintain longitudinal data sets to identify trends and changes over time.

4. **BIOL1613/1611L (Plant Biology):** BIOL1613 is a general education course offered by Biological Sciences in the Spring semester of each academic year. The Spring 2017 semester was the first pre- and post-assessment evaluation of the course. There were 49 students enrolled in BIOL1613 that completed the pre-assessment exam with an average class score of 47.5%. There were 28 members from the same cohort that completed the post-assessment test with an average score of 62.5%; a 15% improvement in the exam score. While there was an improvement in performance for those that completed the post-exam, 19 of 48 students dropped the course with a W (39.5% drop rate). This is a significant concern that will be monitored in Spring 2018 to determine whether this is an aberration. We will maintain longitudinal data sets to identify trends and changes over time.

5. **BIOL2213/BIOL2211L (Human Physiology):** BIOL2213 is a general education course offered by Biological Sciences in the Fall, Spring and Summer of each year. For this course, the assessment exam was developed and initially implemented in Fall 2016, so we have completed multiple semesters of data as indicated in Table 2. The (n) value is the number of students that took the pre- and post- exams. The data indicates that students markedly improve by >20% when comparing the pre- and post-assessment

average exam scores. Over the course of the 2016-2017 academic year, the improvement in scores on the pre- and post-exam were remarkably similar. We will continue to maintain longitudinal data sets to identify trends and changes over time.

Table 2: Assessment scores for Human Physiology

Semester	Average Pre-exam score (%), (n=sample size)	Average Post-exam score (%), (n=sample size)	change in score (5)
Fall 2016	48.4 (n=291)	71.2 (n=290)	+22.8
Spring 2017	53.2 (n=461)	79.9 (n=466)	+26.7
Summer 2017	56 (n=49)	78.8 (n=49)	+22.8

6. **BIOL2443/2441L (Human Anatomy):** BIOL2443 is a general education course offered by Biological Sciences each semester of the academic year. For this course, the assessment exam was developed and initially implemented in Spring 2017. There were 413 students that took the pre-exam with an average score of 48.8%; whereas, 417 students took the post-exam with an average score of 79.9%. The students appear to markedly improve, with a +31.1% increase in scores on the post-exam. We will continue to maintain longitudinal data sets to identify trends and changes over time.

C. Summary:

The BISC assessment plan has provided positive data from Phase I (MCAT), suggesting that our programs are effectively serving our students. In the Spring of 2017 we implemented pre- and post-assessment exams to evaluate our university core courses. From the limited data available, student scores are improving on most of the exams. Some concern with BIOL1584 (Biology for Majors); however, there were extenuating circumstances that may have influenced the scores on the assessment exams. Longitudinal data on this course as well as others will provide us with metrics to use in evaluating the future learning experience in each university general core course.