

University of Arkansas
Department of Biological Sciences
BISC Undergraduate Program Assessment (BIOL BA, BIOL BS)
Report: Academic Year 2019-2020

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

A. General Background:

The Department of Biological Sciences has developed a two-phased assessment plan. Recognizing that the combined BIOL-BA and BIOL-BS programs constitute 1030 undergraduate majors (Spring 2020 enrollment report: BA=284 and BS=746) based on data from the Office of Institutional Research and Assessment and approximately 200 to 250 graduating seniors per academic year, sub-sampling our students seemed the most effective way to assess our program. Phase I assessment utilizes a sub-sampling of our graduating seniors that are pre-medical students taking the Medical College Admission Test (MCAT). This is advantageous because the national MCAT scores are published, providing a benchmark for evaluating our program relative to others nationally. Since our Biology degree requires four core courses (Cell Biology, General Genetics, Evolutionary Biology and General Ecology) that are required for both the B.A and B.S. degree, our assessment considers these degrees together. Phase II of our assessment examines our General Education courses and involves the comparison of pre- and post- test scores for a standardized test administered at the start and end of each semester. The Phase I data are outlined below. The Phase II data on the assessment of our General Education courses is provided in a separate document. We provide cumulative data to establish a longitudinal assessment of our program and our general education courses.

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:

The Department of Biological Sciences graduates approximately 200 to 250 students in the BA and BS programs per year. Many these students are declared premedical students and take the MCAT exam as an entry-level test for Medical School aptitude. The department has access to summary statistics for our students that participate in the MCAT and applied to medical school. Importantly, statistical summaries of the MCAT results nationally are published for all students that applied to medical school. The scoring system for the MCAT changed in April 2015, so our assessment includes scores based on this scoring strategy. Importantly, the combined scores on the MCAT range from 472 to 528 with the mean and median at 500. This provides a mechanism by which to compare UA Biology students with other Biology students nationwide that participated in the same exam. Table 1 shows the data for MCAT scores from 2015 to 2019. These data do not differentiate between Biology BA and BS degree students; however, as indicated above both degrees share identical core biology courses, so we take the data to represent the quality of performance for both degree programs. Moreover, most of the Biology

majors are seeking a B.S. degree (~72%) with the B.A. (~28%) representing a lesser contribution to the overall result.

Table 1: MCAT scores for Biology Majors 2015-2019

YEAR	# BIOL Students	BIOL Majors Average	BIOL U.S.*	Overall U.S.*
2015	57	502	NA	NA
2016	71	501.8	501.6	501.8
2017	81	502.4	504.5	505.8
2018	79	502.8	505.5	505.6
2019	79	504.0	506.0	506.1

* NA: not available

Based on the national average, BIOL majors (BS and BA combined) performed above the MCAT median of 500 (Table 1). While UA BIOL majors are slightly below the national average BIOL majors and the overall U.S. average, we are encouraged by the incremental increases observed since 2017. We have moved slightly closer to the U.S. average for all Biology majors and the U.S. MCAT scores overall which is positive news. We will continue to strive for improvement in our curriculum. Since the new MCAT is focused on critical reasoning skills, our curriculum will continue to improve in this area.

C. Summary:

The BIOL undergraduate assessment continues to provide positive data from Phase I evaluation (MCAT), suggesting that our program is effectively serving our undergraduate students. In 2019, we had 79 BIOL majors take the MCAT with an average score of 504.0 compared to the U.S. BIOL majors average of 506.0. Although our improvement was incremental, we are moving in a positive direction suggesting our Biology degree program is succeeding. Our goal for improvement is to reach or exceed the national average for BIOL majors. At the moment, we have 47 Biology majors accepted to medical school, for an acceptance percentage of 57% as compared to the national average of 41% acceptance rate. Another indicator of our program success.

University of Arkansas
Department of Biological Sciences
Graduate Program Assessment (BIOL MS, BIOL PhD)
Report: Academic Year 2019-2020

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

A. General Background:

The graduate programs in Biological Sciences (M.S. and Ph.D.) offer the opportunity for advanced study and research for students that desire a comprehensive view of biological sciences. Accomplishment is judged by competence and a developing sense of responsibility for the advancement of knowledge rather than the fulfillment of routine requirements. It is expected that all candidates for advanced degrees will have a period of study in residence, complete the required courses in advanced biology appropriate for the chosen discipline, demonstration of advanced competence in the chosen area of expertise, satisfactory introduction to allied subjects, the ability to communicate at a scholarly level, and the satisfactory performance in examinations. As of Spring 2020, the BISC graduate student population is represented by 73 BIOL students, 19 CEMB students, 2 ENDY and 1 SPAC student. For assessment purposes, we only include those obtaining an M.S. or Ph.D. in Biology (BIOL). In the Spring of 2020, the BIOL program had 59 Ph.D. and 14 M.S. students actively enrolled.

For the AY2019-2020 academic year, we are providing data on our single most important metric, namely the scientific careers of our graduates upon completion of their advanced degree. A longitudinal summary (2006 to 2020) of those data are provided for both the M.S. and Ph.D. graduates.

B. Outcome Reporting:

Learning Outcomes: PhD in Biology

- Mastery of the chosen discipline of biology at the graduate level
- Capacity for original research as evidenced by the preparation and defense of a Ph.D. dissertation
- Ability to communicate effectively both as a participant and presenter in graduate seminars
- Demonstrated excellence in the classroom for teaching assistants
- Professional development in science via the presentation of research at national conferences, applying for and receiving nationally competitive grants, publishing research articles and books in the chosen discipline, participation in departmental professional development seminars
- Participation in the academic life of the Department (attending seminars and public lectures)

Learning Outcomes: M.S. in Biology

- Mastery of the chosen discipline of biology at the graduate level
- Capacity for original research as evidenced by the preparation and defense of a M.S. thesis
- Ability to communicate effectively both as a participant and presenter in graduate seminars
- Demonstrated excellence in the classroom for teaching assistants
- Professional development in science via the presentation of research at national conferences, applying for and receiving nationally competitive grants, publishing research articles and books in the chosen discipline, participation in departmental professional development seminars
- Participation in the academic life of the Department (attending seminars and public lectures)

C. Results of Assessment:

For Ph.D. seeking graduate students, we have assessed their continuation in science careers after completion of their doctoral degree in the Department of Biological Sciences. We have classified students into six broad categories:

1. Employed as a faculty member (Instructors, Assistant Professors, Associate Professors, Professors at academic institutions nationally and internationally).
2. Employed in postdoctoral training positions.
3. Employed in nonacademic science (i.e. industry, state or federal agencies).
4. Continued education toward a professional degree (i.e. MD, DO, JD, DDS, etc.)
5. Left the Ph.D. program without completion.
6. Unknown

The results of our longitudinal data from 2006 to 2020 are shown below in Table 1.

Table 1: Longitudinal data on Ph.D. graduates in Biological Sciences.

Ph.D. graduates	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	% Total
Faculty	1	3	3	4	5	2	2	3	0	0	0	0	0	1	0	24	35.3
Postdoctoral	1	0	0	0	1	2	1	3	0	4	4	1	1	2	4	24	35.3
Nonacademic sci.	0	0	1	1	3	0	1	0	1	2	0	1	0	2	1	13	19.1
Professional	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Left Ph.D.	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	5	7.4
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	2.9
TOTAL	2	3	4	5	9	4	4	6	2	8	6	2	2	6	5	68	100

For M.S. seeking graduate students, we have assessed their continuation in science careers after completion of their M.S. degree in Biological Sciences. We have classified students into six broad categories:

1. Employed in science-related technical positions.
2. Continued education toward a Ph.D. at the U of A or other doctoral granting institutions.
3. Employed as science instructors (i.e. K-12, college, etc.)
4. Continued education toward a professional degree (i.e. MD, DO, JD, DDS, etc.)
5. Employment outside of science
6. Unknown or left the program

The results of our longitudinal data from 2006 to 2020 are shown below in Table 2.

Table 2: Longitudinal data on M.S. graduates in Biological Sciences.

M.S. graduates	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	% Total
Employed in science	2	3	2	0	1	1	3	1	5	4	1	5	3	2	3	36	45.6
Education to Ph.D.	3	1	2	1	0	2	0	2	0	3	1	0	1	1	1	18	22.8
Science Instructor	1	0	2	0	1	0	0	0	1	1	1	0	0	0	0	7	8.9
Professional	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2.5
Outside science	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1.3
Unknown	2	0	1	2	0	0	0	0	1	4	1	1	0	2	1	15	19
TOTAL	9	5	7	3	2	3	3	3	7	12	4	6	5	5	5	79	100.1

Summary of Assessment (2006 to 2020):

The Department of Biological Sciences has successfully graduated 147 students (2006-2020) that were awarded advanced degrees (M.S. or Ph.D.) in Biology. The students receiving M.S. degrees maintained a GPA as required to be awarded the degree. Additionally, they have successfully written M.S. theses and defended their theses before a committee of experts in the respective fields of biology. The students receiving Ph.D. degrees have maintained a GPA as required by the University to be awarded the degree. In addition, they have successfully passed both written and oral qualifying examinations to enter doctoral candidacy. Finally, the doctoral students have successfully written doctoral dissertations and defended the dissertation before a committee of experts in their field of biology. Most importantly, the vast majority of M.S. and Ph.D. students (~84%) completing advanced degrees in biology have remained successfully employed in science-related disciplines after completion of their advanced degrees in Biology.

Since 2006 the Department of Biological Sciences has graduated 68 doctoral students with only 5 students leaving the program without degree completion (92.6% completion). Of those that completed their degree, ~35% are employed as faculty members, ~35% are in postdoctoral training positions and ~13% employed in nonacademic science jobs. Most important, students

completing their doctoral degrees in Biological Sciences at the UA are successfully gaining employment (Table 1).

Since 2006 the Department of Biological Sciences has graduated 79 Master's degree students (Table 2). Of those that completed their degree, ~45% are employed in science-related technical positions, ~23% continued their education toward a doctoral degree, ~9% were employed as a science instructor and 2.5% pursued other professional degrees. Thus, students completing their M.S. degrees in Biological Sciences are successfully gaining employment with the majority (77%) remaining in a science-related career.