

**University of Arkansas**  
**Department of Biological Sciences**  
**BISC Undergraduate Program Assessment (BIOL BA, BIOL BS)**  
**Report: Academic Year 2020-2021**

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### **A. General Background:**

Recognizing that the combined BIOL-BA and BIOL-BS programs constitute 1130 undergraduate majors (AY2020 enrollment report: BA=334 and BS=796) based on data from the Office of Institutional Research and Assessment and approximately 200 to 270 graduating seniors per academic year, sub-sampling our students seemed the most effective way to assess our program. Our 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 both the B.A. and B.S. Biology degrees requires four core courses (Cell Biology, General Genetics, Evolutionary Biology and General Ecology), our assessment considers these degrees together. 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.

**Subsampling with the MCAT:**

The Department of Biological Sciences graduated 252 students with either a BA (108) or BS (144) degree in 2020. Many of 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, the 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 exam. Table 1 shows the data for MCAT scores from 2015 to 2021. 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 regarding our biology core classes. Moreover, most of the AY2020 Biology majors are seeking a B.S. degree (~70%) with the B.A. (~30%) representing a lesser contribution to the overall result.

**Table 1: MCAT scores for Biology Majors 2015-2021**

YEAR	# BIOL Students	Accepted med schl	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	41	502.8	505.5	505.6
2019	79	47	504.0	506.0	506.1
2020	93	46	503.9	506.3	506.4
2021	81	48	502.3	505.9	505.9

\* 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 for BIOL majors and the overall U.S. average, we had been encouraged by the incremental increases observed between 2017 and 2019. Unfortunately, we observed a significant drop in test scores in 2021 that is also noted for Biology majors nationwide and with the overall MCAT scores. Whether this was related to Covid-19 and online education is not known, but it will be important to monitor scores for the next few years to determine whether they rebound. While we do not believe there should be a major change in our current curriculum, we will continue to strive for improvement in our current course offerings. Since the new MCAT, implemented in 2015, is strongly focused on critical reasoning skills, our curriculum will continue to improve in this area.

### **C. Summary:**

The BIOL undergraduate assessment continues to reflect positive data based on the MCAT scores, suggesting that our program is effectively serving our undergraduate students. In 2020, we had 93 BIOL majors take the MCAT with an average score of 503.9 compared to the U.S. BIOL majors average of 506.4. Our goal for improvement is to reach or exceed the national average for BIOL majors. In 2020 and 2021, we had 46 and 48, respectively, Biology majors accepted to medical school, for an acceptance rate that continues to exceed 50% as compared to the national average of 41%. Another indicator of our program success.

**Future directions:** We will continue to focus on improving critical thinking skills for our Biology majors. At this time, we do not believe changing the course offerings is necessary, rather a shift in strategy to further develop the ability of our students to analyze data and reach conclusions.

**University of Arkansas**  
**Department of Biological Sciences**  
**Graduate Program Assessment (BIOL MS, BIOL PhD)**  
**Report: Academic Year 2020-2021**

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### **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 2021, the BISC graduate student population is represented by 66 BIOL students, 41 CEMB students, 1 ENDY, 6 STAN and 2 SPAC student for a total graduate enrollment of 116 graduate students. For assessment purposes, we only include those obtaining an M.S. or Ph.D. in Biology (BIOL). In the Spring of 2021, the BIOL program had 55 Ph.D. and 11 M.S. students actively enrolled.

For the AY2020-2021 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 2021) of those data is 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 2021 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	2021	Total	% Total
Faculty	1	3	3	4	5	2	2	3	0	0	0	0	0	1	0	1	25	34.2
Postdoctoral	1	0	0	0	1	2	1	3	0	4	4	1	1	2	4	2	26	35.6
Nonacademic sci.	0	0	1	1	3	0	1	0	1	2	0	1	0	2	1	1	14	19.2
Professional	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1.4
Left Ph.D.	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	5	6.8
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2.7
<b>TOTAL</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>9</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>2</b>	<b>8</b>	<b>6</b>	<b>2</b>	<b>2</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>73</b>	<b>99.9</b>

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 2021 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	2021	Total	% Total
Employed in science	2	3	2	0	1	1	3	1	5	4	1	5	3	2	3	0	36	44.4
Education to Ph.D.	3	1	2	1	0	2	0	2	0	3	1	0	1	1	1	1	19	23.5
Science Instructor	1	0	2	0	1	0	0	0	1	1	1	0	0	0	0	1	8	9.9
Professional	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2.4
Outside science	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1.2
Unknown	2	0	1	2	0	0	0	0	1	4	1	1	0	2	1	0	15	18.5
<b>TOTAL</b>	<b>9</b>	<b>5</b>	<b>7</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>7</b>	<b>12</b>	<b>4</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>2</b>	<b>81</b>	<b>99.9</b>

### Summary of Assessment (2006 to 2021):

The Department of Biological Sciences has successfully graduated 154 students (2006-2021) 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 (~83%) completing advanced degrees in biology have remained employed in science-related disciplines after completion of their advanced degrees in Biology.

Since 2006 the Department of Biological Sciences has graduated 73 doctoral students with only 5 students leaving the program without degree completion (93% completion). Of those that completed their degree, ~34% are employed as faculty members, ~36% are in postdoctoral training positions and ~19% employed in nonacademic science jobs. Most importantly,

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

Since 2006 the Department of Biological Sciences has graduated 81 Master's degree students (Table 2). Of those that completed their degree, ~44% are employed in science-related technical positions, ~24% continued their education toward a doctoral degree, ~10% were employed as a science instructor and 2.4% pursued other professional degrees. Thus, students completing their M.S. degrees in Biological Sciences are successfully gaining employment with the majority (78%) remaining in a science-related career.