

Biology Program Academic Program Evaluation February 5, 2018

Criterion 1 Impact and overall essentiality of the program

Preparing students in the STEM fields is critical to the continued advancement of the communities within the San Luis Valley, the state of Colorado, and the United States as a whole. Given our location, we are well suited to prepare students in fields that impact the environment and our natural resources. Given the poverty level of the San Luis Valley and the inequities in healthcare and access to quality K12 education, we are positioned to prepare students for continued studies in healthcare and as teachers with the goal of them returning to work in underserved areas of Colorado. Several of our ASU alums are currently teaching in local school districts, hold positions with state and federal natural resource agencies, and are practicing physicians, dentists, veterinarians, and pharmacists throughout the San Luis Valley.

The Biology Program aligns with each of the five ASU 2020 goals as described below.

Goal 1 Academic Excellence: Adams State University will provide challenging and responsive curricula that educate, serve, and inspire our diverse populations.

The Biology faculty are committed to providing challenging, relevant courses to prepare our students for continued studies or careers in STEM fields. The B.S. Biology degree tracks require a broad set of coursework outside of biology that includes physics, chemistry, and mathematics. This preparation enables our students to be competitive for careers immediately after earning their degree or post-baccalaureate education and/or professional training.

Biology is a rapidly evolving field and we have made changes to individual courses and the curriculum in response to these advancements (Strategic Initiative 1.1). Courses in Fisheries Management and Vegetation & Habitat Management were added to strengthen our Wildlife degree track and round out students' exposure to management practices. We added a Conservation Biology course to accommodate the changing needs of federal and state resource management agencies and to make students aware of global conservation issues (Strategic Initiative 1.2). A 400-level course in genomics and bioinformatics was added to the Cellular and Molecular degree track in response to new technology (Strategic Initiative 1.1). In addition, we have integrated genomics and bioinformatics learning exercises and research opportunities in both lower and upper division courses.

To better serve our diverse students from the San Luis Valley, we have recently entered into a partnership with Colorado State University to offer an Interdisciplinary Degree in Agriculture - Biology Track (Strategic Initiative 1.3). Likewise, we have partnered with the University of Colorado School of Medicine Physical Therapy Program to develop an MOU for an early admissions program with the intent to increase the number of physical therapists in the San Luis Valley and other underserved areas of Colorado (Strategic Initiative 1.3). This program would allow one or two students per year, who meet the academic criteria and who are underrepresented in the field of physical therapy, to be guaranteed acceptance to the doctor of physical therapy program. This MOU is currently under review by CU's legal counsel.

Goal 2 Student Success: Adams State University will address diverse student needs by offering varied learning opportunities and support services for all students to achieve educational, personal, and career successes.

Student success is at the forefront of what we do on a daily basis, from engaging students in the classroom to providing one-on-one assistance during office hours, academic and career advising, promoting internship opportunities, and engaging students in research.

Faculty in the biology program are committed to high-impact practices in our teaching (Strategic Initiative 2.4 and 2.5) as evidenced by our participation in workshops and conferences focused on pedagogy, such as:

- HHMI National Academies Regional Mountain West Summer Institute on Undergraduate Education in Biology (3 faculty received certification as a National Academies Education Fellow)
- Certificate in College Teaching and Learning; ESCALA Educational Services (3 faculty)
- American Society of Microbiology Biology Scholars Residency in Assessment
- National Center for Case Study Teaching in Science Workshop on Writing Case Studies and Writing Flipped Video Case Studies
- *Diversity in teaching STEM*. AAC&U Conference
- Unidos Equity Leadership Institute
- Online Equity in Education Institute (2 faculty)
- *The Complete Model Teacher: A Workshop with Aaron Richmond* (3 faculty)
- *Practical advice for discovering and nurturing the master teacher within you* with Bill Buskist (3 faculty)
- American Society of Microbiology Conference for Undergraduate Educators (2 faculty)
- Ecological Society of America Workshops
- Genomics Consortium for Active Teaching NextGen Sequencing Workshops (3 faculty)
- Genomics Education Partnership Workshops (2 faculty)
- Human Anatomy and Physiology Conference and Teaching Workshops
- iPlant Collaborative Genomics in Education Workshop
- Peer Learning Assistant model workshop; led by Laurie Langdon from the University of Colorado (2 faculty)

A robust body of evidence, including student tracking over the last 20 years, illustrates the value of research for promoting interest, engagement, and persistence in science (Rodenbusch et al., 2016). Traditionally, undergraduates have gained such experiences through an “apprenticeship” model in which they commit out-of-class time to work alongside a faculty member. However, this traditional model excludes a large number of students, considering that enrollment of STEM undergraduates far exceeds available research spots. Unlike traditional models, moving research experiences into the classroom is an effective and sustainable method to engage diverse student populations in research (Rodenbusch et al., 2016). During summer 2017, two biology faculty participated in the REIL-Biology (Research Experiences in Introductory Laboratories) workshop on developing CUREs for introductory biology courses. In addition, faculty in Porter Hall are currently preparing a grant application to increase CUREs in coursework at the 100-300 level. Thus far, biology faculty have incorporated Classroom-based Undergraduate Research Experiences (CUREs) in several courses (Strategic Initiative 2.4 and 2.5), impacting students in all degree tracks, including:

- Conservation Biology; worked with US Fish and Wildlife Service to map willow habitat for the federally listed Southwest willow flycatcher on the Alamosa NWR
- Ornithology; measured the impact of West Nile Virus on corvids in the US
- Microbiology; understanding the prevalence of antibiotic resistance in regional environmental soil samples
- Molecular Biology II; understanding the evolution of genome structure and its associated changes in how protein coding genes are regulated
- Plant Ecology; measuring the effects of dwarf mistletoe on host physiology, reproduction, and annual growth.

- Plant Physiology; examining water uptake in legumes in response to changing nitrogen levels and *Rhizobium* symbiosis.

In addition to the CURE model, faculty also engage students in mentored research (Strategic Initiative 2.4) which has led to student presentations in a number of venues (Table 1.1).

Table 1.1. Student Research Presentations over a five-year period (AY 2012-13 through AY 2016-17).

Venue	Number of presentations
ASU Student Scholars Day	15
Tri-Beta Regional Conference	13
Front Range Student Ecology Symposium	1
SACNAS National Conference	4
National/International professional societies (e.g., Botanical Society of America, International Congress of Arachnology)	4

Recent projects have direct implications for the local area as well as application to other regions of the US. These projects include:

- Population dynamics of small mammals at the Baca NWR
- Wildlife use of abandoned mines in the Sangre de Cristo Mountains
- Identification of Tetracycline-Resistant Bacterial Strains from Urban Stormwater Discharge Sediment by 16s rRNA Amplicon Sequence Analysis
- Bioinformatic Analysis of Microbial Communities Associated with Natural Occurring Acid Rock Drainage in the Alamosa River Basin
- Quantification of the innate immune response in two subspecies of honeybees (*Apis mellifera*)
- Effects of nitrogen and *Rhizobium* interactions on water uptake in legumes
- Effects of dwarf mistletoe infection on soil biodiversity, nutrient cycling, and nutrient availability
- Southwestern phylogeography of *Arceuthobium divaricatum* determined using the ITS region

ASU Biology students have been very successful in earning awards at the Tri-Beta Regional Conference (12 students earning 3 poster and 6 oral awards; over five years) and ASU Student Scholar Days (15 students earning 4 abstract, 5 poster, and 2 oral awards; over past three years during which awards were given). In addition, one faculty member's paper with undergraduate students published in BIOS 86(2):47-52, 2015 "Nuclear intergenic DNA sequence divergence in a Texas dwarf mistletoe (*Arceuthobium divaricatum*) population" won the McClung Award for the best paper published that year.

In addition to research opportunities, we offer students both paid and unpaid internships with the Bureau of Land Management, as well as other state and federal agencies. Students interested in the health professions have opportunities to obtain shadowing experience through an agreement with the San Luis Valley Regional Medical Center. (Strategic Initiative 2.4)

In the area of advising, all biology faculty actively advise students in their area of specialty as well as specific professional careers (e.g. medical school, veterinary school, secondary education, natural resource agencies). To this end, two biology faculty are members of the National Association of Advisors for the Health Professions (NAAHP) as well as the western regional organization (WAAHP) and both have attended either the national and/or regional meetings to stay current in advising strategies and admissions requirements (Strategic Initiative 2.3). The idea of Appreciative Advising was introduced to the ASU campus because of a NAAHP workshop that was attended by one of these faculty. For many years, the STEM department faculty assisted pre-professional students through the Health Professions Advisory Committee (HPAC). This is now a campus-wide committee, but is administered through the STEM departments and is chaired by a biology faculty member. The HPAC provides guidance to students on their application materials, conducts mock interviews, and writes letters of recommendation. In terms of advising the wildlife majors, faculty maintain professional contacts with various natural resource agencies.

Goal 3 Personal and Professional Development: Adams State University will provide educational and professional development opportunities for faculty and staff.

The biology faculty have received support from the department, the VPAA Faculty Development Fund, the Office of the President, the Title V HSI-STEM grant, and other Title V grants for a number of educational and professional development opportunities (both on and off campus), such as:

- HERS Institute (Strategic Initiative 3.2)
- Linton-Poodry SACNAS Leadership Institute (Strategic Initiative 3.2)
- GCAT-SEEK Summer Workshop on RNA-Seq and how to use it in your courses (3 faculty) (Strategic Initiative 3.2)
- Appreciative Advising workshop (3 faculty) (Strategic Initiative 2.3)
- Attendance at national conferences (all faculty) (Strategic Initiative 3.3)
- Hilos Culturales Summer Institute (Strategic Initiative 3.1)
- "Meeting the Post-Secondary Needs of Diverse Learners through a Culturally Responsive Lens" Workshop (Strategic Initiative 3.1)
- Human Anatomy and Physiology Teaching Workshops (Strategic Initiative 3.2)
- Summer Faculty Fellowship with the US Fish and Wildlife Service (Strategic Initiative 3.2)

Goal 4 Access & Affordability: Adams State University will develop innovative pricing and aid strategies that will maximize opportunities for our diverse and historically underserved students for all levels and delivery models.

While our program does not participate in setting institutional fee structures for students, we have kept our course fees at a minimum. The course fee was increased from \$13.80 to \$20 per laboratory course in fall 2014, compared to laboratory fees at other Colorado universities that are \$20 or more. These fees help to offset the cost of laboratory materials, equipment repair and calibration, and field travel, as our budget has not kept pace with inflation. Despite this, we are providing students with high quality programming and experiences with state of the art equipment and technologies.

In addition, we offer tutoring and supplemental instruction, free of charge to ASU students enrolled in STEM courses, through the STEM Center (Strategic Initiative 4.1). Through the Porter Scholars program, we are able to provide scholarships and funding for Focused Academic Programs (*i.e.*, research, academically related travel). The biology program has also set aside a small pool of funds for undergraduate research expenses. These funds are awarded

on a competitive basis through a grant application process to students who are not Porter Scholars or who do not qualify for CO-AMP funding.

Goal 5: Community Relations: Adams State University will collaborate with the community to provide culturally responsive and sustainable development opportunities that mutually benefit the campus and the San Luis Valley community.

Faculty and students within the biology program have organized, participated in, or supported a variety of activities that address this goal. Examples of these activities include:

- Organize the *Faculty Lecture Series* (2012-2017). The goal of this series is to provide opportunities for the community to learn about research or areas of interest of ASU faculty. (Strategic Initiative 5.1)
- Contribute to the "Lifeways" Lecture Series, a place-based lecture series. (Strategic Initiative 5.1)
- SACNAS members volunteered for the BLM *Plumas de Familia* outreach event (Strategic Initiative 5.1)
- Networking dinner hosted by SACNAS to connect students with local professionals in STEM. (Strategic Initiative 5.3)
- Organize the annual SLV Crane festival at which ASU Tri Beta students volunteer (Strategic Initiative 5.3 and 5.4)
- Tri-Beta members participate annually in the ASU Cares Day and CROP Hunger Walk (Strategic Initiative 5.3)
- Tri-Beta members volunteer at the Bridge Assisted Living Center, Alpine Veterinary Hospital, Alamosa Wildlife Refuge Visitors Center, and La Puente Soup Kitchen (Strategic Initiative 5.3)
- A Biology faculty member led the E.A.R.T.H. Group in organizing a Riparian Restoration Community Service Project along the Rio Grande, coordinating a Rio Grande River Corridor Cleanup, Campus Garden Development day in partnership with La Puente VEGI, a reduce and reuse community sale on campus, screening a sustainability themed film on Earthships, and co-sponsoring the SLV Climate March (Strategic Initiative 5.3)

Biology faculty members have contributed to a book called "The San Luis Valley: Geology, Ecology, and Human History." This edited volume will help to build understanding of the natural and cultural history of the SLV among our campus and community (Strategic Initiative 5.4).

The Biology program cultivates relationships with alumni (Strategic Initiative 5.6). For example, professors invite alumni who work in natural resource management agencies here in the SLV to give talks to current students. This cultivates relationships with alumni, the agencies, and benefits our current students. We also invite alumni to speak at Tri-Beta, SACNAS, and Porter Scholar events.

Narrative discussing components or items associated with a program that are essential to Adams State but are not found within ASU2020

The Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) is a national organization that started over 40 years ago to promote diversity in the sciences. Adams State started a chapter in 2013 and since then, our SACNAS chapter has participated in activities such as:

- organize and run 1-2 STEM Saturdays a year for the past 3 years
- hosted two networking dinners; invited STEM professionals from the community to meet our students and talk about their careers

- hosted presentation by Michael Gonzales from Soymap to talk about epigenetics and summer internship opportunities
- hosted a resume workshop
- hosted a SACNAS travel scholarship essay workshop
- faculty advisor has taken over 30 students to 4 National SACNAS Conferences
- participate in AS&F, ASU Cares day, and Homecoming activities
- fundraising activities include weekly chili sales and 5K fun-runs

Criterion 2 Quality of program outcomes

Results of annual assessment reports

Assessment feedback was provided in different formats throughout the last five years, with numerical scores provided only for the past 3 years. The feedback is summarized in Table 2.1.

Table 2.1. Summary of assessment feedback. Numerical scores were based on the scale of Excellent = 2, Adequate = 1, and Incomplete = 0

Short-form Question	AY 12-13	AY 13-14	AY 14-15	AY 15-16	AY 16-17
Information/Evidence/Data Gathered to Inform Department of Student Learning	Excellent	Adequate	0.67	1.625	1.714
Departmental Discussion of Information	Excellent	Excellent	1.67	1.625	2.000
Discoveries/conclusions	Adequate	Adequate	0.83	1.875	2.000
Planned Actions Based on Discoveries About Students and Their Learning	Excellent	Excellent	0.83	1.875	2.000
Support/resources	Excellent	Excellent	1	1.625	1.857

The biology faculty have developed a better understanding of the assessment process over the last five years and are committed to using the information to improve our curriculum. This commitment is demonstrated by the improvement in our “scores” as we develop better knowledge of assessment tools and techniques.

A few noteworthy comments from the most recent evaluation:

- *It is clear that the department takes assessment seriously, with a retreat, rubric calibration, and follow-up meeting. Using multiple assessments for each SLO is also a major plus.*
- *I love that this department is really digging in and using their data to drive instruction. This commitment will allow more goals to be met in the future. The implementation of the Scientific Writing course is a great idea. I like that new rubrics have been developed and are being used.*

Scores of graduates on national assessments

The biology program uses the ETS Major Field Test in Biology as a measure of achievement. The five-year test score data is presented in Table 2.2.

Table 2.2. Comparing Graduating ASU Biology Majors and National Means on the ETS Major Field Test

Year	ASU mean	ASU N	National Institutional Mean	National Institutional N
2013	156	11	152.1 (+/- 8)	488
2014	164	11	152 (+/- 7.9)	509
2015	155	19	152 (+/- 7.9)	511
2016	152	13	151.9 (+/- 7.5)	440
2017	156	16	151.9 (+/- 7.8)	467
Five-year Average	156.6	14	151.98	483

ASU students have performed at or above the national mean on the Biology Major Field Test each of the last five years. This is consistent with the 25-year average score of 157.8 for ASU Biology seniors (the 25-year National Institutional mean is not available).

Jobs secured by graduates

The faculty within the biology program are committed to preparing graduates that are nationally competitive for biology related jobs (e.g., natural resource agencies, biotechnology industry) and secondary education positions. Based on student-reported data, over the past 5 years our placement rate has been 100% in all areas and the 25-year average is also very high (Table 2.3).

Table 2.3. Biology Program Job Acceptance Rates (Hiring rate is given as percent of students who applied and were hired. This data is student-reported and may not include all students who applied for positions. 5-year average is based on graduates in AY2012-13 through AY2016-17. *Note that industry hires were not tracked until AY 2012-13.)

Position Type	5-year		25-year rate	
	% of graduates applying	Hiring rate	% of graduates applying	Hiring rate
Natural Resource Agencies	10.7	100	19	93.9
Industry*	15.6	100	na	na
Secondary Educators	6.7	100	7.6	100

In the last five years, we have placed at least 22 students in internships with different resource management agencies and non-government agencies, and at least 18 of our graduates have found permanent jobs in natural resource management, industry, and teaching in local schools.

Admission and admission rates to graduate or professional schools

The faculty within the biology program aim to prepare graduates that are nationally competitive for acceptance into graduate and professional schools (e.g., medical, dental, veterinary, allied-health). As evidence of our success, our students have very high rates of acceptance with 5-year and 25-year averages presented in Table 2.4.

Table 2.4. Biology Program Acceptance Rates (% acceptance is given as percent of students who applied and were accepted. This data is student-reported and may not include all students who applied. 5-year average is based on graduates in AY 2012-13 through AY 2016-17.)

Position Type	5-year rate		25-year rate	
	% of graduates applying	% Acceptance	% of graduates applying	% Acceptance
Graduate school	12	33.3	12.8	85.2
Medical school	9.3	57.1	9.3	82.1
Veterinary school	0	0	3.6	80.0
Dental school	5.3	100	2.6	90.9
Allied Health Professions	12	66.7	10.2	81.4

While the five-year average for acceptance to health professional programs and graduate schools is lower than the 25-year average, it should be noted that this data includes 12 recent graduates who are waiting on acceptance notification. In the last five years, 3 students have matriculated into a graduate program, 4 into medical school, 4 into dental school, and 2 into other health professional programs.

The Health Professions Advisory Committee, whose membership is predominantly biology program faculty, advises students from across campus and provides mock interviews, critiques on personal statements, and suggestions on how to compose a competitive application. The advising by biology program faculty undoubtedly has affected the success of these students.

Criterion 3 Demand for the program

Internal demand

In reviewing the Induced Course Load Matrix, it is apparent that the biology program is not only educating our majors, but is also providing service to other majors (i.e., chemistry, nursing, and HPPE). Many biochemistry students complete a minor in biology and we offer specific service courses for the pre-nursing and HPPE students (e.g., Nutrition, Human Anatomy & Physiology, Human Anatomy, and Non-Majors Microbiology). The program also offers a popular general education Introductory Biology course that does not have a mathematics prerequisite. Table 3.1 summarizes the percent of biology credit hours completed by these majors as well as all other majors combined, which is an indication of our service to general education on campus.

Table 3.1. Percent of Biology credits completed by student major.

Year	Biology majors	Chemistry majors	HPPE majors	Pre-Nursing majors	All others
2014-15	34.8	18.4	8.3	9.3	29.2
2015-16	34.8	15.2	7.5	8.7	33.8
2016-17	34.5	10.8	9.2	8.6	36.9
Average	34.7	14.8	8.3	8.87	33.3

It should be noted that while the total university headcount has decreased from 3444 in 2012-13 to 2750 in 2016-17, a decrease of ~20%, the head count in biology has decreased by 18% (181 in 2014-15 to 148 in 2016-17). In addition, over the five-year period, 53 students completed a biology minor.

Employment opportunities: national and state statistics

National employment outlook for biology majors:

According to the Bureau of Labor Statistics, projected job growth in fields that our graduates have historically entered range from 3.8 – 37.4%, with a mean projected growth of 14.6% between 2016 and 2026 (Table 3.2). Of note is the diversity of potential biology-related careers listed by the Bureau of Labor Statistics that our graduates have pursued.

Table 3.2. National estimates of Biology-related job growth from 2016 to 2026.

Occupations are based on historic Biology program graduate placement. Data are predicted percentages of job growth. (Bureau of Labor Statistics)

1. Biological science teachers, postsecondary	15.1
2. Biological technicians	7.9
3. Biological scientists, all other	10.2
4. Dental assistants	19.5
5. Dentists, general	17.5
6. Environmental science technicians	11.9
7. Environmental science teachers, postsecondary	9.6
8. Environmental scientists & specialists	11.1
9. Fish and game wardens	4.3
10. Fishing and hunting workers	7.2
11. Forest and conservation technicians	3.8
12. Forest fire inspectors & prevention specialists	26.6
13. Forestry and conservation science teachers, postsecondary	7.7
14. Genetic counselors	28.3
15. Physical therapists	25.0
16. Physician assistants	37.4
17. Physicians	13.3
18. Radiologic technicians	12.3
19. Surgeons	16.8
20. Veterinarians	18.1
21. Veterinary technicians	19.9
22. Zoologists and wildlife biologists	7.5

Average projected job growth **14.6 %**

In Colorado, the most recent data we could find were the number of biology-related jobs in the state in May, 2016 (Table 3.3). These data show nearly 45,000 biology-related jobs in Colorado, which made up nearly 2% of all jobs in the state (Table 3.3, not including jobs in health care facilities).

Other data indicate that the job outlook for Molecular or Cellular Biologists in Colorado has been positive since 2004. Vacancies for these careers have increased by 16.23 percent nationwide in that time, with an average growth of 2.71 percent per year. Demand for Molecular and Cellular Biologists is expected to continue to increase, with an expected 7,170 new jobs in Colorado by 2018. This represents an annual increase of 2.9 % for the next few years. (Recruiter.com)

Table 3.3. State Occupational Employment Estimates for Colorado for May, 2016. These estimates were calculated with data collected from employers in all industry sectors in metropolitan and nonmetropolitan areas in Colorado. (Bureau of Labor Statistics)

	Number employed ¹	RSE ²
1. Natural science managers	1330 +/-	7.2%
2. Microbiologists	450	22.2
3. Soil and plant scientists	230	27.5
4. Zoologists and wildlife biologists	640	8.8
5. Biological scientists, all other	820	5.8
6. Conservation scientists	1170	9.6
7. Epidemiologists	320	10.6
8. Medical scientists other than epidemiologists	1130	6.4
9. Life scientists, all other	60	0
10. Environmental scientists and specialists, including health	3140	8.3
11. Biological technicians	2860	2.5
12. Environmental science and protection technicians, including health	830	18.4
13. Forest and conservation technicians	1170	4.4
14. Life, physical, and social science technicians, all other	930	10.0
15. Biological science teachers, postsecondary	990	5.1
16. Forestry and conservation science teachers, postsecondary	70	0
17. Environmental science teachers, postsecondary	100	4.0
18. Chiropractors	970	9.0
19. Dentists, general	2020	13.8
20. Pharmacists	5510	7.9
21. Family and general practitioners	3810	9.2
22. Surgeons	930	14.7
23. Physician assistants	2850	5.7
24. Physical therapists	4740	4.3
25. Veterinarians	2050	6.8
26. Medical and laboratory technicians	2000	6.3
27. Veterinary technologists and technicians	3660	7.7
28. Genetic counselors	60	26.3
Biology-related jobs in Colorado	44,840	
Percentage of biology-related jobs in Colorado	1.8	

¹ Number employed out of a total of 2,507,680 jobs

² RSE = Relative Standard Error

10-year trend of graduates

The number of biology graduates has remained relatively steady over the last ten years, with a dip in 2008-09 and a recent increase over the last three years (Figure 3.1). We are expecting approximately 16 graduates in 2017-18.

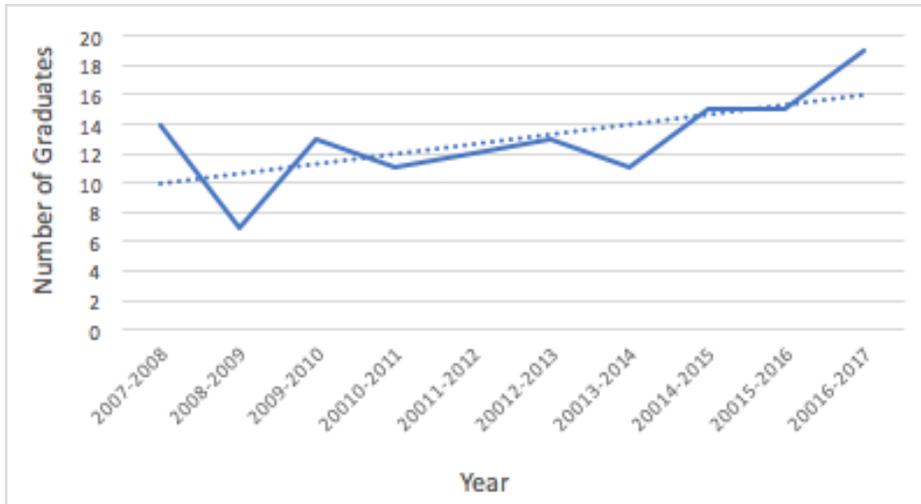


Figure 3.1. Total number of Biology graduates over a 10-year timeframe (2007-08 through 2016-17)

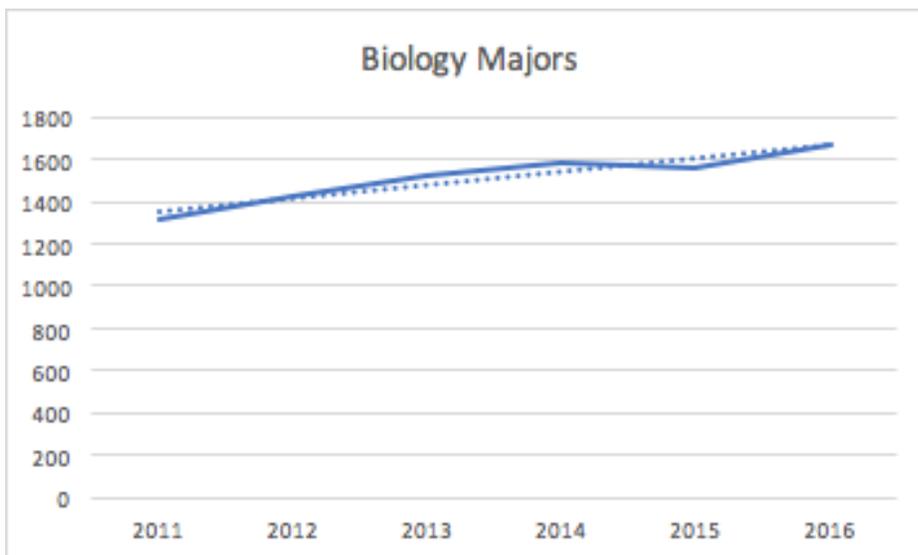


Figure 3.2. Trend in biology graduates in the state of Colorado

The 10-year trend of an increase in graduates with an undergraduate degree within the biological sciences at ASU correlates with trends observed at the state level (Figure 3.1 and 3.2).

Table 3.4. Degrees awarded by degree track over a 10-year timeframe (2007-08 through 2016-17).

Year:	1	2	3	4	5	6	7	8	9	10	Total
BA Liberal Arts	2	1	0	0	1	1	1	0	0	1	7
BA Science Education	0	0	0	0	0	0	0	0	0	0	0
BS Organismal	2	0	2	2	2	3	5	3	2	3	24
BS Cell/ Molecular	7	3	6	7	4	6	4	8	6	7	58
BS Wildlife	3	3	5	2	5	3	1	4	7	8	41

The degrees awarded by degree track has predominantly been consistent over the past 10-years, while it should be noted that there are currently multiple students pursuing the BA in science education degree (Table 3.4). Considering national trends and predicted employment and job growth data (Table 3.2 and 3.3), the Biology program anticipates a continued trend of increased demand.

Criterion 4 Size, scope, and productivity of the program

The biology program serves a large number of students both within and outside the major. The average student credit hour for biology is above the average for the university and the number of degrees awarded is equivalent to the median (Table 4.1). The five-year average for biology degrees awarded is 15, the same as the university median of 15 degrees awarded (excluding interdisciplinary degrees). Faculty in the biology program also engage undergraduate students in original research and mentor them in their internships, as well as serve on graduate students' thesis committees.

In addition to directly serving students, faculty serve the campus, community and discipline. Faculty actively participate in campus-wide committees and leadership, engage the community of all ages, and serve the academic discipline.

Degrees awarded

Table 4.1. Biology degrees awarded and number of degrees per faculty. The number of degrees per full-time faculty was calculated using 5.5 as the department chair teaches a half-time load.

year	# of degrees awarded	degrees/full-time faculty
2012-13	13	2.4
2013-14	11	2.0
2014-15	15	2.7
2015-16	15	2.7
2016-17	19	3.5
Total	73	13.3

Over the last few years there has been an upward trend in the number of biology graduates. In the last ten years, there have been 130 biology students graduating with either a BA (7) or BS (123) degree.

Student credit hours (SCH) and Total SCH generated by program

In addition to teaching all biology courses, biology faculty also teach ENV 101 (general education course) during either fall or spring semester. As ENV 101 is typically offered Fall, Spring, and Summer only one-third of the SCH for this area is included in the calculations for the Biology Program (Table 4.2).

Table 4.2 Total SCH and SCH per faculty. The SCH per full-time faculty was calculated using 5.5 as the department chair teaches a half-time load. Average SCH per unit was calculated as Total University SCH / number of Organizational Units.

year	SCH (Biology)	SCH (ENV)	Total SCH	SCH/FT Faculty	Average SCH per academic unit
2012-13	3062	202.7	3264.7	593.58	1810.8
2013-14	3054	237.3	3291.3	598.42	2001.3
2014-15	3352	198.7	3550.7	645.58	1901.4
2015-16	3172	210.7	3382.7	615.04	1743.7
2016-17	3128	164	3292	598.55	1610.9
Average	3153.6	202.68	3356.28	610.23	1813.6

The average total student credit hour for biology exceeds the average SCH per academic unit at Adams State, illustrating that the demand for biology course offerings exceed the average course demand.

Service to campus

All tenured and tenure-track faculty within the department are expected to participate in campus service, with the exception of first-year faculty who need the time for course development. Despite not requiring campus service of the P1 faculty, during the past five years both of our P1 faculty have participated in campus service. Table 4.3 shows the number of committees, task forces, or other campus-wide service activities by faculty member.

Table 4.3. Campus-wide service by faculty member for a five-year period (2012-13 to 2016-17) This table includes the number of committees in each category on which an individual faculty member served. Number of years served is indicated parenthetically. *Faculty 5 began employment at ASU in August 2016, thus this data represents 1.5 years of service; **Faculty 6 left ASU following 3 years of employment and the service listed is not complete, but based on memory of current faculty in the department. The replacement is in a visiting position and is not required to participate in campus service.

	1	2	3	4	5	6
Standing Committees (CRC, GECC,	HPAC (2)	Faculty Senate	HPAC (5)	HPAC (5)		HPAC

HPAC, Student Scholar Days)	CRC (3)	FTAC (2) Student Scholar Days (5) President's Advisory Group (3)	Nursing Advisory Board (5) Handbook (1)	Student Scholar Days		Student Scholar Days (2) FTAC (1)
Search Committees (Outside Department)	Library director	Sociology 2 for HPPE Inclusive Excellence Liaison ASU President Title V Connexiones Grant Activity Director	VPAA Director of Nursing			
Retention Committees (Outside Department)	Nursing (3)	Sociology	2 Nursing faculty CCSM (1)			
Task Forces (ASU 2020, STAMP, CIT, HIP Team)	Colorado Faculty Advisory Committee Mentored new STEM faculty (2)	HIP Team Honors Program Proposal Committee Title V HSI-STEM Steering committee	ASU 2020, Goal 1 Mentored new faculty Title V HSI-STEM Steering committee One-Card Trade Study (2) Summer Salary Faculty Searches & Diversity (2) Program Approval Committee	STAMP CIT HIP Team Adams Pathways Theme Faculty Committee EARTH Group Communications Task Force Leader (3)	AAA Review Committee	

			ASU-CSU Ag program MOU Academic Master Plan			
Tenure, Promotion, Peer Recognition Committees	Tenure and promotion (2) Peer recognition (2)		Promotion (1)			
Service to other ASU departments			Teacher Education Admission Interviews (2) Content Supervisor for student teacher		HPPE Master's Committee	HPPE Master's Committee Teacher Education Admission Interviews

Biology faculty are members of standing campus committees that are necessary for the function of a university. By serving on multiple search committees across campus, biology faculty participate in the important job of new faculty recruitment and hiring. Biology faculty have also been active in shaping new programs, advancing new initiatives, and drafting the ASU strategic plan. In addition to serving our undergraduate students, Biology faculty also serve graduate students by participating in Master's Thesis Committees in other departments.

Fraction of tenured & tenure-track faculty engaged in campus-wide committee leadership (chairs)

In addition to serving on campus-wide committees, members of the biology program faculty have assumed leadership roles on these committees (Table 4.4).

Table 4.4. Campus-wide committee leadership by faculty member for a five-year period (2012-13 to 2016-17) This table includes the committees in each category on which an individual faculty member served in a leadership position. Service years is indicated parenthetically. *Faculty 5 began employment at ASU in August 2016, thus this data represents 1.5 years of service; **Faculty 6 left ASU following 3 years of employment and the service listed is not complete, but based on memory of current faculty in the department. The replacement is in a visiting position and is not required to participate in campus service.

	1	2	3	4	5	6
Standing Committees (CRC, GECC, HPAC, Student Scholar Days)	Co-chair, CRC (2)	Co-chair, Student Scholar Days		Chair, HPAC (3) EARTH Group Coordinator		

Search Committees (Outside Department)		Chair, Inclusive Excellence Liaison Search	Co-chair, VPAA search Chair, Director of Nursing			
Retention Committees (Outside Department)						
Task Forces (ASU 2020, STAMP, CIT, HIP Team)				HIP Team		
Tenure, Promotion, Peer Recognition Committees						
Service to other ASU departments						

The data in table 4.4 represent two full professors, two assistant professors and two newly promoted associate professors (3 years and 1 year). Although a fairly young department, members have assumed leadership roles across campus as appropriate (we would not expect probationary faculty to assume leadership roles within the first three years of employment).

Service to community & community engagement

A University is often the heart of its community, offering community members academic and creative programming. The biology faculty have been engaged in a wide variety of community service activities (Table 4.3)

Table 4.5. Service to the community and community engagement by faculty member for a five-year period (2012-13 to 2016-17). This table includes the community service activities in each category in which an individual faculty member participated; number of events/years is given parenthetically. Leadership positions are also noted. *Faculty 5 began employment at ASU in August 2016, thus this data represents 1.5 years of service; **Faculty 6 left ASU following 3 years of employment and the service listed is not complete, but based on memory of current faculty in the department. The replacement is in a visiting position and is not required to participate in campus service.

	1	2	3	4	5	6
P-12 Outreach (STEM Saturdays, material loans, classroom visits)	Loan specimens and equipment to local K12 teachers. (5) STEM Saturday (1)	STEM Saturdays (7) STEM Academy organizer and leader (4) Migrant Education Program STEM Academy organizer	STEM Academy organizer and leader Boy Scout Merit Badge Counselor (2)	STEM Saturdays (2) STEM Academy organizer and leader (2) Migrant Education Program STEM Academy organizer and leader (2)		STEM Academy organizer and leader (3) Migrant Education Program STEM Academies organizer and leader STEM Saturday

		<p>and leader (2)</p> <p>Outreach for Guadalupe Elementary School</p> <p>BLM Plumas de Familia event</p> <p>Cumbres and Toltec Botany Train</p> <p>Faculty Lecture Series Organizer (5)</p> <p>Visitors to the Herbarium (4)</p>		<p>San Luis Valley Area Health Education Center's Summer Health Career Institute Faculty Session Leader (4)</p> <p>Citizen science research project in microbiology with Sargent High School</p>		
SLV Regional Science Fair, local school fairs	<p>Team leader (2)</p> <p>Supported Bill Metz' Seconds on Science program (2)</p> <p>Helped prepare Del Norte HS students for Envirothon (2)</p>	Team leader (5)	Team Leader (4)	Team Leader (4)	Judge (1)	Team Leader (2)
Professional Organizations	<p>President of the Friends of the San Luis Valley National Wildlife Refuges (5)</p> <p>Volunteer with USFWS and CPW (5)</p> <p>Mentored refuge support groups nationally for USFWS (3)</p>	SACNAS Conference Panelist, Conference Mentor, Judge		<p>Network for Integrating Bioinformatics into the Life Sciences Education Assessment Validation Committee Member</p> <p>Genome Solver Board Member</p>	Human Anatomy and Physiology Society, Outreach Committee Member	
Community Leadership (School)	Advisory Personnel Performance	500 Women Scientists Leadership Board	PEO, officer (3)	Colorado Field Institute Board (Vice President) (2)		

Boards, agency boards)	Evaluation Council MVSD					
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All biology faculty employed during the Title V HSI STEM grant period, have developed STEM Saturdays and/or summer STEM Academies to engage K-12 students in STEM. Faculty have also mentored SLV high school students. This serves to spark the interest in STEM at a young age and prepare them academically as well as a potential recruiting tool. Some STEM Academy participants have subsequently enrolled at ASU.

The Biology faculty also offer educational opportunities for adults in the community including Earth week activities, lecture series, and summer field institutes.

Brief write-in summary of discussion & evidence pertaining to this criterion, but not captured by the above measures

In addition to serving students through our courses, the biology program offers a budding undergraduate research program that has served 32 students and an internship program with BLM that has served 17 students in the past 5 years.

Criterion 5 Cost & Benefit of the program

Salaries and program delivery costs

Table 5.1 Cost of the Biology Program Note that these calculations are based on AY 2017-18 faculty salaries (two full professors, two associate professors, one assistant professor, and one visiting professor). *One biology faculty member was promoted from assistant to associate professor, effective fall 2017, thus the faculty costs are higher than would have been in AY 2016-17. **The Administrative Assistant position, SMT Instructional expenses, and SMT Administrative expenses are shared with two departments (4 programs) in Porter Hall. The costs provided here represent ¼ of the total cost. ***The Laboratory Support position is shared between the Biology and Chemistry Programs; ½ of the salary and benefits is used here.

Cost Type	Amount
Faculty Salaries*	\$356,429
Faculty Benefits	\$148,083
Operating Expenses	\$16,576
Laboratory Course Fees	\$11,235
Administrative Assistant Salary**	\$10,857
Administrative Assistant Benefits**	\$2,471
SMT Instructional Expenses**	\$2,559
SMT Administrative Expenses**	\$923.75
Laboratory Support Salary***	\$11,708

Laboratory Support Benefits***	\$5,764
Porter Hall Vivarium	\$1,000
Total Cost of Program	\$567,605.75

Table 5.2 Cost of the program per metric. All calculations are based on AY 2017-18 faculty salaries. *One biology faculty member was promoted from assistant to associate professor, effective fall 2017, thus the faculty costs are higher than they would have been in AY 2016-17. While the department chair teaches a half-time load, the full-time salary and department chair stipend are included in the total costs, thus 6 FT faculty were used in the calculations. **Calculation based on the average number of graduates in the past three years. ***Calculation based AY 2016-17 SCH.

Metric	Amount
cost/FT faculty*	\$94,600.96
cost/graduate**	\$34,758.47
cost/SCH***	\$172.42

Revenue generated by the program

The following revenue was generated over the past five years:

- John and Anita Hertner established an endowment to fund scholarships for biology majors.
- Faculty in the biology program have contributed to the following grants in support of our program:
 - *Increasing Student Engagement and Success in STEM Studies (ISES STEM) at Adams State College; \$3,600,000 over five years*
 - *Digitization TCN: Collaborative Research: Using Herbarium Data to document plant niches in the high peaks and high plains of the Southern Rockies – past, present, and future; The grant was funded in the amount of \$1,585,917. Adams State will receive \$17,045.*
- Grant application in process:
 - NSF Improving Undergraduate STEM Education: Hispanic-Serving Institutions Program; estimated budget is \$1,500,000 over five years

Formal and documented recruiting efforts by program personnel

Faculty in the biology program have participated in the following recruitment activities:

- ASU Bus Tour
- ASU Discover Days
- ASU Road Trip campus recruitment luncheon
- Faculty have represented ASU at the Colorado Science & Engineering Fair to award scholarships
- SLV Career Fair (2016 and 2017)

- Community College Resource Fair at the 2016 and 2017 National SACNAS Conference
- Four radio interviews in the summer of 2017 promoting Adams State University's interdisciplinary agriculture program in partnership with Colorado State University
- Developed new rack cards for the biology and Porter Scholars program

Evidence of recruiting success

The biology program does not have data related to matriculation of particular students. However, at the Community College Resource Fair at the 2016 and 2017 National SACNAS Conference, faculty met with potential transfer students and had over thirty students express interest with at least four submitting applications to Adams State University. In addition, some small number of students receiving scholarships at the Colorado Science & Engineering Fair have matriculated at Adams State.

Brief write-in summary of discussion & evidence pertaining to this criterion, but not captured by the above measures.

Collaboration or partnerships with other institutions are likely to increase ASU's and the Biology Program's visibility, leading to better recruitment and retention.

1. MOU agreement that is being finalized between CU and ASU for direct entry of ASU students that meet prerequisites, GPA, and testing minimums into the physical therapy program
2. CSU currently has a scholarship for 1 ASU graduate within their graduate programs under the umbrella of biology. This needs to be promoted to ASU students.
3. Current agreement with CSU for the BA Interdisciplinary Studies: General Agriculture, Biology track

Criterion 6 Faculty & program strengths and accomplishments

Faculty credentials, skills, flexibility, breadth/depth, etc.

All tenured and tenure-track faculty in the biology program have a terminal degree. We are essentially one-deep in terms of expertise and faculty are often stretched in terms of teaching courses that are outside of their specialty area. This does not provide us with much flexibility in cases of faculty leaves (sabbatical, parental, medical) and due to location, it is often difficult to hire locally to fill temporary vacancies.

Faculty are committed to continued training and have the following additional credentials:

- Three faculty earned certification as a National Academies Education Fellow
- Three faculty earned certificates in College Teaching and Learning (ESCALA Educational Service)
- American Society of Microbiology Biology Scholar in Assessment
- Myers-Briggs Type Indicator Certification
- Physical Activity in Public Health Specialist
- Preparing future faculty practicum and certificate in teaching

Faculty are also committed to service to the academic discipline and have held a variety of positions (Table 6.1).

Table 6.1. Service to the academic discipline by faculty member for a five-year period (2012-13 to 2016-17) This table includes the organization in each activity category in which an individual faculty member served. Number of years is indicated parenthetically. *Faculty 5 began employment at ASU in August 2016, thus this data represents 1.5 years of service; **Faculty 6 left ASU following 3 years of employment and the service listed is not complete, but based on memory of current faculty in the department. The replacement is in a visiting position.

	1	2	3	4	5	6
Adjunct faculty at another institution	New York University School of Continuing and Professional Studies/Paul McGhee Division (2)					
Reviewer		Ford Foundation Fellowships (5) NSF Proposals Journal of Biogeography (2) SACNAS National Conference Abstracts Arctic, Antarctic, and Alpine Research Open Educational Resources: Biology for Majors, Photosynthesis chapter	Promotion review for faculty at UC Denver	Crowdfunding Research Experience for Undergraduates proposals (2) University of Wisconsin's curriculum guide plan "Conceptual Elements" Network for Integrating Bioinformatics in Life Sciences Education (NIBLSE) Learning Resource CourseSource	Economics and Human Biology	Herpetological Journal Journal of Arachnology Research grant proposals for University of Texas at Arlington chapter of the Phi Sigma Society (2)
Judge at Regional/National Scientific Conferences	TriBeta poster and oral presentations (2)	SACNAS Travel Awards American Society for Plant Biologists special award at SACNAS		TriBeta poster and oral presentations (5)	TriBeta poster and oral presentations	TriBeta poster and oral presentations Society for Integrative and Comparative Biology, poster

		<p>SACNAS poster presentations in ecology</p> <p>TriBeta poster and oral presentations (4)</p> <p>Juror for the LEAP National Juried Competition at Adams State</p>				presentations (2)
Fellowships	USFWS Summer Faculty Fellowship					
Assessment				<p>Network for Integrating Bioinformatics in Life Sciences Education (NIBLSE) Assessment Validation Committee (AVC) member</p> <p>Prevalence of Antibiotic Resistance in the Environment (PARE) Project Assessment Committee member</p>		
Board member	President, Friends of the San Luis Valley National Wildlife Refuges (5)	500 Women Scientists Leadership Board		Genome Solver Project (3)		
Facilitator		Session Facilitator, Conference of the Senior Ford Fellows		Facilitator of the National "Read the Room" Classroom		Session chair, Society for Integrative and Comparative Biology (2)

				Research Study		
Conference/Workshop Host			ASU Appreciative Advising Workshops	2016 Tri-Beta Biology Honors Society Regional Conference		

Faculty are also committed to scholarly activity by presenting papers, publishing, and applying for grants. Faculty activity is presented in Table 6.2.

Table 6.2. Scholarly activity by faculty member for a five-year period (2012-13 to 2016-17)

This table includes the number of presentations, publications, and grants by individual faculty. *Faculty 5 began employment at ASU in August 2016, thus this data represents 1.5 years of service; **Faculty 6 left ASU following 3 years of employment and the service listed is not complete, but based on memory of current faculty in the department. The replacement is in a visiting position and is not required to participate in campus service.

	1	2	3	4	5	6
Presentations	Poster at the American Ornithologists' Meeting Student Scholar days (co-author) TriBeta Regional meeting (co-author) USFWS National Conservation and Training Center	Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) National Conference (6) Student Scholar Days (Co-author) (5) Northern New Mexico College Botanical Society of America (2) Front Range Ecology Symposium (Co-author) TriBeta Regional Conference (Co-author) (3)		American Society for Cell Biology (3) American Society for Microbiology Conference for Undergraduate Educators (3) National Association for Biology Teachers Tri-Beta Regional Conference (Co-author) (5) Student Scholar Days (Co-author) (5)	TriBeta Key Note Speaker	Society for Integrative and Comparative Biology (2) International Congress of Arachnology SACNAS National Conference (co-author)

Papers	Coauthored book chapter Vertebrates of the San Luis Valley in <i>The San Luis Valley: Its Geology, Ecology, and Human History</i> Coauthored book chapter A Culture of Conservation in <i>The San Luis Valley: Its Geology, Ecology, and Human History</i>	Physiologia Plantarum BIOS Scientific American (2) Book chapter Plants and Ethnobotany of the San Luis Valley in <i>The San Luis Valley: Its Geology, Ecology, and Human History</i> Journal of Biogeography	CourseSource (Submitted)	Journal of Biological Chemistry (2) National Center for Case Study Teaching in Science (2) Trends in Genetics Fine Focus Journal of Microbiology & Biology Education CourseSource (Submitted)	CourseSource (Submitted)	Ethology
Grants	Faculty Technology Advisory Committee (2) Title V Research and Engagement Grant (2)	NSF \$1,585,917 LI-COR Environmental Education Fund (LEEF) grant. \$52,120 ASU Title V Teaching Improvement Grants (3), \$5,000 FTAC grant	Department of the Interior, Student Internships, \$150,000 NSF ADVANCE, co-PI \$149,000 Title V Student Engagement Grant HSI-STEM grant, \$4.5 million (not funded)	NSF, \$152,000 (Submitted) ASU Title V Research and Engagement Grants (2), \$8,000 ASU Title V Teaching Improvement Grants (2), \$4,000 ASU Hilos Student Engagement Grant, \$1,000		HSI-STEM Title V grant AS&F Campus Impact Fund

Quality of the curriculum

While we don't have external accreditation in biology, we have implemented some best practices that are a component of the AAAS (American Association for the Advancement of Science) *Vision and Change in Undergraduate Biology Education* document (e.g., CUREs, independent research, case-based learning, peer-led team learning, inquiry-based laboratories; Table 6.3) (Brewer and Smith, 2011). While we have not fully implemented all of the recommendations, we are strategically and systematically making changes in our curriculum, particularly at the lower division, to increase student success and retention of students. An assessment of programs is now available to determine how individual programs align with the recommendations put forth, but we have not yet had an opportunity to undertake this study.

The Human Anatomy and Physiology course has been aligned with recommendations by the Human Anatomy and Physiological Society in both course content and modes of delivery, ensuring that this service course is meeting national standards.

Table 6.3. Courses employing best practices identified in the AAAS *Vision and Change in Undergraduate Biology Education* document. (Brewer and Smith, 2011)

	CURE (Course-based undergraduate research)	Independent Research	Case-based learning	Peer-led team learning / Peer-Learning Assistants	Inquiry-based laboratories	Capstone project
Courses	Conservation Biology Microbiology Molecular II Ornithology Plant Ecology	Plant Physiology	Cellular Biology Genetics Anatomy and Physiology Human Anatomy	General Biology I Genetics	General biology II	Thesis I Thesis II

Quality of physical, online, or other resources (equipment, software, facilities, etc.) required to deliver the program

The Biology program is housed within Porter Hall, a newer building that was occupied in 1998. At the time of occupation and in the years since, we have been able to update much of our laboratory equipment and seating. The most recent STEM grant has allowed us to purchase new bright-field microscopes with phase adapters for the teaching laboratories and a specialized fluorescent microscope for both teaching and research. We replaced our old floor-model centrifuge, -80°C freezer, a pressure chamber, and outdated photo-documentation system with newer equipment. Additionally, we acquired a real-time quantitative PCR instrument and benchtop micro-centrifuges. We also expanded our inventory of micro-pipettors and electrophoresis equipment to make this equipment more accessible to multiple courses. Our students have the benefit of using modern equipment and they gain experience with modern technologies.

We have invested thousands of dollars to improve our collection of anatomy models, as well as skins and skulls for the Mammalogy teaching collection. Our anatomy models are heavily relied upon in our service courses (e.g., BIOL 112 and BIOL 205/206) and are shared with other programs when needed (e.g., for the Wilderness/First-responder course). In addition, we have an extensive collection of confiscated animal products on permanent loan from US Fish and Wildlife Service. We maintain teaching collections for insects, plants, and vertebrates. A live plant collection is also maintained in the recently constructed greenhouse.

Our new collaboration with CSU to offer an Agriculture program at ASU is of potentially great benefit to the San Luis Valley and will allow students from small communities to earn an agriculture degree from a small university rather than attending CSU.

Travel is arguably one of the best educations. One faculty member has taken 110 students overseas to places of unique biological interest, including 41 students since 2012. For many of

our students, these trips were their first opportunity to travel overseas to learn about other places and cultures, and for many, the experience was life-altering.

Criterion 7 Future potential of the program

The biology faculty have identified four areas of opportunity that would increase student retention, degree completion, and possibly recruitment. Implementation of some of these best practices (AAAS Vision and Change in Biology Education) would require one additional full-time faculty. The need for this faculty line is discussed under the appropriate proposals (2.c.i, 4.c.i.). Faculty within Porter Hall, including four biology faculty, are currently working on a NSF grant proposal that would provide funding to initiate some of these practices, but a faculty line is not within the scope of the grant.

Fully Developed Ideas

1. Expand the integration of CUREs within courses (with a focus on the 1st & 2nd year level)
 - a. Objectives
 - i. Increase student engagement and retention
 - ii. One target outcome would be to showcase a career in research or pursuing graduate school (something our program does not emphasize), which may help in retention of pre-professional health students that no longer want to pursue a health profession career.
 - b. Associated Costs
 - i. Funds for faculty project development and piloting project with undergraduates outside the classroom
 - ii. Travel for training (CURE best practices)
 - c. Projections and Evaluation Metrics
 - i. Increase student retention, understanding of the scientific process, self-efficacy, identifying as a scientist, engagement, ownership of the experiments/data
 - ii. Student perception surveys, monitoring students longitudinally, comparison to archival data, retention data, performance on internal and external standardized knowledge tests, focus groups
2. Independent research/Internships
 - a. Objectives
 - i. Increase student retention, success of first-generation, low-income, and those traditionally underrepresented in STEM
 - ii. Increase retention of faculty/reduce faculty burnout
 - b. Background
 - i. Undergraduate research has been shown to increase retention and success of students, especially students who are first-generation, low-income, and traditionally underrepresented. Many undergraduate institutions acknowledge this positive effect and are increasing undergraduate participation in original research. However, high contact hours in the classroom decrease time for engaging undergraduates in research and the one-on-one mentorship critical for student retention. A survey of six peer institutions in Colorado reveals that Adams State biology faculty have higher classroom contact hours/week (14-21 hours compared to a 13.5 average) per 12 credit-hour load (1 FTE). Four of the six peer institutions provide some sort of course release for research. An additional faculty member would enable faculty to commit more time to undergraduate research and mentorship.
 - ii. Expand opportunities with the existing BLM internship program and other government, non-profit, and private organizations.
 - c. Associated Costs
 - i. Faculty Salary and Benefits
 - d. Projections and Evaluation Metrics

- i. Retention and recruitment
 - ii. Placement into professional degree programs, graduate school, or employment
- 3. Student Mentoring/Career Exploration
 - a. Objectives
 - i. Increase student retention, success of first-generation, low-income, and those traditionally underrepresented in STEM
 - ii. Build a community of biology majors, first through fourth year students
 - b. Background
 - i. Offering a 1 credit course for upperclassmen in the major who, by invitation only, participate in peer mentoring with underclassmen, in an effort to increase student retention (especially for first-generation college students and underrepresented minorities). Mentors would work with students regarding study skills and building a community of learners. In addition, a first-year workshop would be taught by program faculty to increase student knowledge of potential career paths. A designated professional advisor for STEM fields would also benefit ASU students with regard to understanding the complex process of preparing for application to professional or graduate school. This position would likely be half-time and could also be responsible for oversight of the STEM Center, tutoring, and outreach (making it a full-time position).
 - c. Cost
 - i. Mentor Training
- 4. Reduce Class Sizes in High Failure Rate Courses
 - a. Objectives
 - i. Increase student retention, success of first-generation, low-income, and those traditionally underrepresented in STEM
 - ii. Increase retention of faculty/reduce faculty burnout
 - b. Background
 - i. As mentioned above, improving student retention and success is a priority. Due to staffing constraints, the largest-enrollment courses we offer (BIOL 209, 205, 206, 112) also tend to have the highest failure rates. For instance, the largest service course (in terms of students per section) on campus, Human Anatomy & Physiology (HA&P), tends to have higher numbers of students who are first-generation, low-income, and traditionally underrepresented yet the high enrollment is counter to the small class sizes in which Adams State prides itself. Additionally, this course has a high failure rate, which could be addressed with more faculty 1-on-1 interactions in smaller sections. The effects of reducing the size of sections of HA&P would likely also be felt in other ASU programs such as the Nursing program, which requires students to be successful in this course to apply to the program. An additional faculty member would enable additional sections to be offered resulting in more faculty 1-on-1 interactions with students. Additionally, another faculty member would benefit biology majors by allowing smaller sections of general biology to increase student pass rate in those critical early years of the student's education.
 - ii. We also propose offering sections of two-semester courses (BIOL 209, 210, 205, and 206) both fall and spring, to address roadblocks to completion that transfer students encounter due to lack of course offerings. Transfer students, who typically have to wait to resume the course sequence at ASU, accumulate more student debt and increase ASU's average time until graduation beyond the target 4-years.
 - c. Associated Costs
 - i. Faculty Salary and Benefits Line (see 2.c.i.)

Ideas under development:

1. New degree track targeting pre-professional health students
 - a. This has a high likelihood of broadly influencing recruitment of students to ASU considering the ASU pre-professional health page receives the most hits/traffic of all the subpages of the ASU website as reported to the Biology Program by Creative Relations that monitors website traffic.
 - b. The Medical College Admissions Test requires knowledge of sociology and psychology, beyond the introductory level, and we would propose partnering with these departments when structuring this new degree track.
 - c. We also envision a service-learning component within this degree track to expose students to the healthcare professions and to diverse populations.
2. Many of our students who enter the teaching profession do not complete the BA Biology/Science Ed degree, but rather seek alternative licensure or a Masters in teacher education. In the past, students had the option of the Master's Plus program which was very popular among our students who decide late in their undergraduate career to pursue teaching. We would propose bringing back this type of opportunity to increase STEM teachers.
3. Requirement for all biology majors to complete a scientific writing course. One perennial area our students struggle with is scientific writing. We believe that a solid foundation in scientific styles of writing would benefit our students, not only with their performance in biology courses, but also to enhance their competitiveness in matriculating into graduate or professional school.
4. Potential new interdisciplinary emphases in biotechnology, forensics, or bioinformatics.

Potential for online presence:

Our heavy reliance on laboratory-based courses limits our ability to offer courses online effectively. One potential offering would be nutrition, a non-laboratory based course that is under review for General Education and GT Pathways.

Final summary

The first half of the 20th Century was dominated by discoveries in physics that changed our understanding of our world. The second half of the century began with the description of the structure of DNA in 1953 by Watson and Crick, which started a revolution in our understanding of genetics and opened the way for us to manipulate DNA. The 21st Century will be dominated by advances in biology that allow us to repair and customize DNA, and holds the promise of individually-customized medicinal treatments that will revolutionize how we treat disease, aging, and virtually every aspect of our environment. Biologists have been genetically engineering bacteria and fungi for industrial processes for years, and they are currently perfecting methods to bring back extinct species. In addition to these new technologies, as the human population continues to grow, we will need more biologists and other scientists who can think critically to help address our increasing impacts on wildlife, plants, and ecosystems.

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