El Camino Community College

PROGRAM REVIEW 2019

DIVISION OF NATURAL SCIENCES

LIFE SCIENCES - BIOLOGY

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SECTION 1
Overview of the Program

A) Description of the Current Program and Mission Statement

Include in this section any program highlights and/or accomplishments, as well as the most critical needs of the program.

The mission of the Biology Program is to offer quality educational opportunities for students by providing courses that transfer to four-year institutions and offering associate degrees that meet general education and major requirements. Maintaining optimal academic standards, ensuring availability of academic and student support services, providing facilities to support teaching and learning, and supporting professional development for faculty are vital to our mission.

Biology Program faculty members are well-qualified to teach the courses in the program and maintain rigorous academic standards. They are actively involved in institutional effectiveness efforts through varied committee commitments. Campus-wide and off-campus activities, such as the Onizuka Science Day, student club activities, and the Alondra Park Project foster a positive campus climate and promote community outreach and service-learning.

Academic support for students is in the form of Supplemental Instruction (currently, Biology 10 and Biology 15) and tutoring. Collaborative working relationships exist to promote student success with the Counseling Division, the Learning Resources Center (LRC), the Guided Pathways Committee, and student support programs like the Mathematics, Engineering, Science Achievement Program (MESA) and the Honors Transfer Program (HTP). Of note is the MESA program. At the MESA transfer dinner 2019, approximately 20% of the students listed in the program transferred in a biology-related major. The majority of those transferred to the University of California. Success is also reflected in our students' participation in competitive research activities like the UC Irvine Bridges Program, the USC Global Environmental Microbiology Summer Course, and the Boston University Summer Training as Research Scholars Program. In addition to these, 3 of 24 students that participated in USC's NSF REU Community College Cultivation Cohort (C4) from 2016-2018 were ECC biology students.

A collaborative Hispanic-Serving Institution (HSI) STEM Grant (in partnership with Mt. St. Mary's College) and an institutional HSI-STEM Grant both ended in 2016. The grants, collectively, funded academic support endeavors, research opportunities, and outreach activities. Grant funded activities ceased when the grants ended; however, Supplemental Instruction, which began in Biology 10 with grant monies, has continued with other funding sources.

Our most pressing needs are as follows: academic support for our students in the form of Supplemental Instruction expansion to more biology courses, critical (safety-related) infrastructure modifications to house equipment (microscopes), increased supply budgets to accommodate increased costs of consumables, increased funds for equipment replacement, and a consistent schedule for replacement of projectors and computers in the lab and lecture classrooms.

B) Degrees and/or Certificates Offered by the Program and Students Served

The Biology Program includes courses in general, organismic, molecular, and environmental biology. These courses meet the educational needs of our diverse community. Biology major and non-major students as well as those previously degreed students preparing for professional school make up most students served. The courses provide a comprehensive lower division curriculum for science majors preparing to transfer to 4-year universities. They allow a student to pursue an Associate of Science degree in Biology or General Science. A Biology for Transfer degree, AS-T, for improved CSU admission opportunities is not currently offered. Biology at El Camino College (ECC) is a high unit major. Preparation includes biology, inorganic and organic chemistry, physics, and calculus-based mathematics. An AS-T degree may not include organic chemistry nor a full year of mathematics (AS-T degrees in Biology at Cerritos College and Pasadena City College serve as examples). Our strength is in our students' preparation and decreasing the major requirements would be counterproductive. General education courses are designed to allow students to understand and apply the scientific method, and to understand basic underlying principles of nature and the relevance to their lives. Field courses may be required for career education and serve as opportunities for lifelong learning.

C) The Program Fulfills the College's Mission and Aligns with the Strategic Initiatives

The mission of El Camino College is to make a positive difference in people's lives by providing a comprehensive educational programs and services that promote student learning and success in collaboration with our diverse communities.

STRATEGIC INITIATIVES

1. **Student Learning:** Biology Program faculty members enhance teaching to support student learning using a variety of instructional methods and services. For example, we hold periodic brown bag discussions on instructional approaches that have had a degree of success in current or previous classes. Formal professional development activities on instructional methodologies are also taken advantage by both full-time and part-time faculty members.

2. **Student Success and Support:** Biology Program faculty members are continuously evaluating their approaches in the classroom. This evaluation leads to opportunities for change in the classroom that enhances student success. Accessibility to full-time faculty members underlie mentorship/guidance opportunities that provide consistent support. Referrals to counseling, financial aid, student support programs/activities, and the health center are made as needed.

3. **Collaboration:** Biology Program faculty members foster a sense of community and cooperation through an effective process of collaboration and collegial consultation. We work closely with other disciplines within the Natural Sciences, programs like HTP and MESA, the LRC, and counseling.

4. **Community Responsiveness:** Biology Program faculty members foster community responsiveness by participating in Onizuka Space Science Day and developing varied partnerships with educational institutions (e.g. UC Riverside student research activities,

the Keck Graduate Institute articulation agreement, USC REU community college liaison, and Mt. St. Mary's College collaborative STEM grant).

5. **Institutional Effectiveness:** Biology Program faculty members are involved in continual efforts to improve processes, programs, and services through the effective use of assessment, program review, planning, and resource allocation. Faculty member participation in departmental, division, and campus-based committees contribute to institutional effectiveness. Such activities are ongoing endeavors.

6. **Modernization:** Biology Program faculty members are in full support of modernization efforts. Recommendations on instructional equipment and technology improvements are periodically made. Classroom infrastructure (i.e. microscope storage) upgrades are regularly proposed. Assessments of needs and wants are a part of the planning cycle.

D) Status of Recommendations from the Previous Program Review

1. **Recommendation:** "Hire two Biology instructors, one to prepare for the eventual retirement of one faculty member within the next three years, and another to support our non-majors program currently staffed by a large number of part-time faculty members. Approximate Cost: $196,000 (pay and benefits/year)."
   Status: Active
   Notes/Comments: One faculty member was hired to replace a faculty member that retired in 2016. A second faculty member was requested to provide continuity of instruction and consistent student contact in our non-majors courses. Many of our non-majors biology sections are taught by part-timers that teach at other institutions and, as such, leave once the class is over. Students do not have the option of office hour availability, nor mentorship possibilities, by these faculty members.

2. **Recommendation:** "Give priority to lab expenditures for equipment, consumables, and lab furniture replacement to maximize students' hands-on experience. Included in this are monies for molecular biological instruction, the purchase of a greenhouse and ancillary equipment, replacement of microscopes in LS 105, equipment replacement, equipment repair/maintenance costs, and the replacement of lab chairs in NATS 127 and 129. Approximate Cost: $255,600 (including tax, shipping and handling for non-contract components)."
   Status: Active
   Notes/Comments: This is active in part because supplies are always in need and costs increase on a yearly basis. The greenhouse and ancillary equipment have not been purchased. However, microscopes for LS 105 were replaced and lab chairs in NATS 127 and 129 were replaced as well.

3. **Recommendation:** "Increased monies for academic support for non-majors and majors courses. The approximate cost is $1,700/course for Supplemental Instruction. The course selection to be determined collaboratively."
   Status: Active

Notes/Comments: Only Biology 10 has had Supplemental Instruction. While it is anticipated that an increase in the number of courses will have Supplemental Instruction Fall 2019 because of Guided Pathways monies, it is not clear that such monies will persist. A consistent source of funds is critical for sustainment. This must be a priority.

4. **Recommendation:** "Hire a technician to care for the living as well as fixed/stuffed/preserved specimens. Approximate Cost: $70,000 (pay and benefits/year) for a full-time technician. Faculty members are open to a part-time technician at minimum."
   Status: On Hold
   Notes/Comments: This request is left for another day. The first three recommendations are the priority. It must be noted, however, that not addressing this at some point may compromise content knowledge SLOs. The collection must not fall into disarray. It is critical for a multitude of courses within the program.

5. **Recommendation:** "Construction of additional instructional laboratories, along with preparatory and storage space. Approximate Cost: Appropriate campus departments/personnel will need to be consulted to determine the cost of adding additional laboratory classroom and storage space."
   Status: On Hold
   Notes/Comments: This is a long-term goal.

SECTION 2
Analysis of Research Data

A) Head Count of Students in the Program

	2014-15	2015-16	2016-17	2017-18	Avg.
Unduplicated Students	1,991	1,863	1,836	1,865	1,889

For the 2015 Program Review, the 4-year average was 1,678 of unduplicated students in the program. For this evaluation period, the 4-year average is 1,889. This represents an average increase of 211 students per year. We served more students during the current 4-year period than in the previous 4-year period.

B) Course Grade Distribution: Non-major and Major Courses

COURSE	Semester/ Session #	A	B	C	D	F	W	Total	Success
NON-MAJOR:									
Biology 8	4	23 (18.5%)	31 (25.0%)	21 (16.9%)	7 (5.6%)	9 (7.3%)	33 (26.6%)	124	60.4%
Biology 10	14	1006 (22.9%)	1221 (27.8%)	1080 (24.6%)	272 (6.2%)	217 (4.9%)	599 (13.6%)	4395	75.2%
Biology 10H	7	138 (57.0%)	66 (27.2%)	23 (9.5%)	5 (2.1%)	3 (1.2%)	7 (2.9%)	242	93.8%
Biology 11	4	36 (24.6%)	30 (20.5%)	39 (26.7%)	9 (6.2%)	11 (7.5%)	21 (14.4%)	146	71.9%
Biology 12	4	24 (25.5%)	19 (20.2%)	21 (22.3%)	9 (9.6%)	7 (7.4%)	14 (14.9%)	94	68.1%
Biology 15	8	124 (20.4%)	130 (21.4%)	89 (14.7%)	57 (9.4%)	63 (10.4%)	144 (23.7%)	607	56.5%
Biology 16	4	33 (39.8%)	13 (15.7%)	19 (22.9%)	1 (1.2%)	4 (4.8%)	13 (15.7%)	83	78.3%
Biology 17	5	42 (14.2%)	55 (18.6%)	60 (20.3%)	29 (9.8%)	26 (8.8%)	83 (28.1%)	295	53.2%
Biology 18	4	19 (26.8%)	23 (32.4%)	8 (11.3%)	1 (1.4%)	4 (5.6%)	16 (22.5%)	71	70.4%
AVERAGE:									**69.7%**
MAJOR:									
Biology 101	8	187 (20.0%)	262 (28.1%)	199 (21.3%)	65 (7.0%)	52 (5.6%)	168 (18.0%)	933	69.4%
Biology 101H	2	10 (18.9%)	21 (39.6%)	7 (13.2%)	7 (13.2%)	1 (1.9%)	7 (13.2%)	53	71.7%
Biology 102	8	87 (18.6%)	152 (32.5%)	134 (28.7%)	23 (4.9%)	11 (2.4%)	60 (12.8%)	467	79.9%

Biology 102H	2	12 (20.3%)	21 (35.6%)	15 (25.4%)	3 (5.1%)	0 (0.0%)	8 (13.6%)	59	81.3%
Biology 103	4	15 (12.3%)	38 (31.1%)	29 (23.8%)	8 (6.5%)	5 (4.1%)	27 (22.1%)	122	67.2%
AVERAGE:									**73.9%**
OVERALL AVERAGE:									**71.2%**
Biology 99 (Independent Study)	1	1 (100.0%)							
IRP Dashboard									**72.6%**

Based on the calculations from the table above, our overall average success rate is 71.2% for the full 4-year period. Our non-majors success rate stands at 69.7% while our majors program success rate is at 73.9%. An argument could be made that students in the majors program are more highly motivated for the subject matter than the students in the non-majors courses where the primary motivation is fulfillment of degree/transfer and/or work requirements. If the courses with success rates of less than 70% are looked at a bit more closely (Biology 8, Biology 12, Biology 15, Biology 17, and Biology 103), 4 of 5 courses had higher withdrawal percentages than the courses with higher success rates. The data are 26.6%, 23.7% 28.1%, and 22.1% (for 8, 15, 17, and 103, respectively). This suggests that a significant number of students are not persisting in the courses. For Biology 103, students are required to have Biology 101, Biology 102, and varied chemistry courses behind them. These students are well-prepared for the course. Biology 103 is typically the last course taken prior to transfer and, often, so are other STEM courses. In short, students tend to carry heavy loads with biology, chemistry, physics, and/or math. Heavy loads increase the chance of schedule reconsideration during the semester with drops that follow to ease the academic pressure. Also, it is not atypical to see students with Bs dropping as they are motivated by the pursuit for As. Regarding our non-majors courses, many are taught by part-timers that frequently teach at other institutions. They are not present on campus daily and they are not required to hold office hours. The students are not served well from this perspective. Instructor availability promotes discussion of course content, intervention when academic trouble arises, and encouragement of student mentoring.

C) Success Rates

Success Rate: The percentage of students who receive a grade of A, B, C, or Credit as a final course grade. This percentage reflects the number of successful students out of *all the students* who were enrolled at the census date.

Utilizing 2017-18 as a barometer of our most recent performance, our success rate of 76.7% in biology is higher than the institutional average of 71.6%. The State of California average (degree applicable/transferable filters) in Biology (General), for the same period is calculated at 74.5% (http://datamart.cccco.edu). Our 4-year average of 71.2% (as high as 72.6%) is higher than the 4-year institutional average of 70.3%. We are doing well overall, but we could be doing better with

varied demographic groups. The table on the next page shows that African Americans, Hispanics, and Pacific Islanders have not been as successful over the 4-year evaluation period as have Asians and non-Hispanic Whites. The reasons for this may be multi-factorial but, as biology educators, we certainly have control over our approaches to content in the classroom. For example, varied faculty members have participated in professional development focused on active learning methodologies (through endeavors like the Transforming STEM Teaching Faculty Learning Program in collaboration with California State Dominguez Hills and the HHMI STEM Workshop at Mt. San Antonio College), employed culturally relevant tools (making the content relevant to the students and teaching with humility as examples), and adopted open educational resources (OER) to increase textbook access by financially compromised students. The 2017-18 academic year shows improvements over the previous three years.

	2014-15	2015-16	2016-17	2017-18
Institution, Overall	68.8%	69.9%	70.8%	71.6%
Biology, Overall	70.1%	72.1%	71.5%	76.7%
African American	**55.1%**	**59.8%**	**56.5%**	**67.0%**
Asian	75.1%	82.2%	80.6%	85.2%
Hispanic	**67.8%**	**66.8%**	**67.6%**	**72.4%**
Pacific Islander	**40.0%**	77.8%	**66.7%**	77.8%
White	81.7%	83.7%	84.6%	82.0%

D) Retention Rates

Retention Rate: The percentage of students who remain enrolled through the end of a course out of all the students enrolled at census date. It is the percentage of students who did not withdraw.

COURSE	**Semester/ Session #**	**Retention**		**COURSE**	**Semester/ Session #**	**Retention**
NON-MAJOR:				**MAJOR:**		
Biology 8	4	74.0%		Biology 101	8	82.0%
Biology 10	14	87.6%		Biology 101H	2	86.9%
Biology 10H	7	97.2%		Biology 102	8	88.0%
Biology 11	4	85.2%		Biology 102H	2	82.8%
Biology 12	4	84.4%		Biology 103	4	75.8%
Biology 15	8	76.3%				
Biology 16	4	85.1%		**AVERAGE:**		**83.1%**
Biology 17	5	72.6%				
Biology 18	4	79.3%				
AVERAGE:		**82.4%**				
				OVERALL		**82.6%**
				AVERAGE:		

Based on the calculations above, our overall retention rate for the 4-year period is 82.6%. We are successfully retaining a significant percentage of students in both non-majors and majors courses. For the 4-year period, our lowest retention rate is 72.6% and our highest is at 97.2%. We are doing well but could be doing better, especially in individual courses. There are multiple reasons for student drops. There are students that are not passing and drop a course; or, there are students that are passing but are not doing as well as they wish. In such cases, approaches noted in C) above would conceivably lead to improvements in retention rates. Many of our students work 16 hours or more per week (43% of those surveyed, Spring 2019 Student Survey) and this could impact retention. One approach employed by students to ease the academic pressure is to drop a course. Instead of dropping a course during the semester, a practical strategy for students would be to take fewer courses at the start of the semester (debatable in the era of Guided Pathways) or work fewer hours (often not possible). For the last year of the 4-year period, our 2017-18 program retention rate is 86.0%. This is higher than the overall institutional retention rate of 84.1%. The program percentage is comparable to the percentages seen during each year of the last evaluation period, which would suggest that our retention percentages for the first three years of the current evaluation period are lower (see table above). It is not clear as to the reasons that underlie the data. Given this, our focus will be on what we can control and that is instructional strategies that will, at minimum, maintain the high program retention rate of 2017-18.

E) A Comparison of Success and Retention Rates in Face-to-Face Classes with Distance Education Classes

Distance education classes in biology were not offered during the evaluation period. Thus, such an analysis was not performed. Two hybrid online Biology 10 sections are on the schedule for Fall 2019 and such an analysis is left for the next 4-year evaluation period.

F) Enrollment Statistics: Total Annual Program Participation from 2014-15 to 2017-18

	2014-15	2015-16	2016-17	2017-18	Avg.
Annual Seat Count (Enrollment)	1,972	1,884	1,930	1,871	1,941

	2014-15	2015-16	2016-17	2017-18	Avg.
Sections	54	54	56	56	55
Seats (Enrollment)	1,972	1,884	1,930	1,871	1,914
Unduplicated Students	1,991	1,863	1,836	1,865	1,889
Seats/Unduplicated Students	0.99	1.01	1.05	1.00	1.01

Fill Rate: Percent of Fill for Biology Courses at Census

	2014-15	2015-16	2016-17	2017-18	Avg.
Fill Rate	103%	99%	98%	95%	99%

For the 2015 Program Review, the 4-year average was 1,824 of enrolled students in the program. For this evaluation period, the 4-year average is 1,941. This represents an average increase of 117 students per year. The course section number has increased over the current evaluation period to 220 from 200 for the last evaluation period. The increase in students was readily accommodated. Our fill rate is, on average, nearly 100%, not over as with the last period where our fill rate was at 106%. This suggests we do not need to add additional courses.

G) Scheduling of Classes

Offerings (Sections)	2014-15	2015-16	2016-17	2017-18
Day	42 (77.8%)	42 (77.8%)	44 (78.6%)	44 (78.6%)
Night	12 (22.0%)	12 (22.0%)	12 (21.4%)	12 (21.4%)
Total	54 (100%)	54 (100%)	56 (100%)	56 (100%)

Roughly 80% of the offerings are during the day with approximately 20% of the offerings during the evening. The fill rate for daytime (102%, 99%, 98%, and 95%, respectively) and night-time offerings (107%, 96%, 95%, and 94%, respectively) are on average greater than or equal to 98%. During the last evaluation period, the fill rate was consistently over 100%. The difference between the two evaluation periods is a greater number of offerings for the current period (200 vs. 220). Once again, this suggests we do not need to add additional sections. Both majors and non-majors courses are offered Monday through Thursday, with some non-majors course sections offered on Fridays. Online courses were not offered during the current evaluation period, but the first hybrid online biology course (two sections of Biology 10) will be offered Fall 2019. This will offer students greater flexibility and benefit the institution with a greater FTES number.

H) Improvement Rates: Persistence

Biology 101/Biology 102/ Biology 103 are the only courses in a sequence. While Biology 101 and Biology 102 are required for Biology 103, students are not required to take Biology 101 before Biology 102. The content covered in each is sufficiently different and Biology 101 (Evolution, Ecology, Eukaryotes) is not required for success in Biology 102 (Cellular Structure and Function, Genetics, Prokaryotes/Viruses). Each course does have chemistry requirements, though. Issues arise when students take both Biology 101 and Biology 102 during the same semester. The load is heavy, especially when combined with other STEM courses. Students are typically negatively impacted when they choose to take both during the same semester. They need to be advised and encouraged against concurrent enrollment. STEM Counselors are aware of this issue, but students may not follow advice whether from a counselor or a faculty member.

A Guided Pathways Map may provide some assistance in dealing with the issue. Regarding Biology 103, not all students that are eligible to take the course do so as transfer institutions vary in their requirement for transfer credit in biology (e.g. UCLA does not require the course while UC Berkeley does require the course).

I) Additional Data Compiled by Faculty

i) *Completer Success Rate*: The percentage of students who receive a grade of A, B, C, or Credit as a final course grade. This percentage reflects the number of successful students out of *those that complete the course*. This excludes students who withdrew/received a W.

4 Years	A	B	C	D	F	W	Total	Completer Success %
Total Grades	1757 (22.8%)	2082 (27.1%)	1744 (22.7%)	496 (6.4%)	413 (5.4%)	1200 (15.6%)	7692 (100.0%)	86.0% (w/o Ws)

Students that complete their biology classes at ECC do so successfully. Over the period from Fall 2014 to Spring 2018, the average success rate for students completing their biology courses was an impressive 86.0%. The striking discrepancy between success rates of students completing the course (86.0%) and that of all students that enrolled in those courses (71.2%) is due to the large number of students that drop with a W. Withdrawals need to decrease to ensure timely progression towards degree/goal attainment. Increased academic, counseling, and financial support are critical in decreasing the number of withdrawals.

ii) Supplemental Instruction for Improved Success and Retention

Our lead Biology 10 faculty member, Nancy Freeman, has employed Supplemental Instruction rather (SI) consistently since Spring 2012 (originally funded by an Hispanic-Serving Institution STEM grant from the US Department of Education, and subsequently funded through other monies after the grant ended in 2016) and she has demonstrated that success and retention have improved. A representative example of her results is shown below:

Fall 2016	**Biology 10-1086 (no SI coach)**	**Bio 10-1087 (with SI coach)**
Exam 1 Results (# of Students):		
90%	2	5
80%	6	4
70 %	1	14
60%	10	3
50%	10	10
40%	11	3
Exam 2 Results (# of Students):		
90%	5	9
80%	7	11
70%	10	13
60%	8	3
50%	7	3

Fall 2016	**Biology 10-1086 (no SI coach)**	**Bio 10-1087 (with SI coach)**
Exam 3 Results (# of Students):		
90%	11	18
80%	7	6
70%	12	12
60%	3	2
50%	1	1
	-5 students dropped before Exam 3 -3 did not take Exam 3	-1 student dropped before Exam 3

Per Nancy Freeman: "If we are looking for ways to improve retention and success of our students, there is no doubt in my mind that SI tutoring is the single most effective way to help students start strong and stay in the class…I have been teaching for 35 years, and in my opinion SI coaching is the most effective use of our financial resources to support student success and retention. This is not a single event for this semester, these results are consistent over the years I have been working with SI coaching in my classes. They are not determined by the individual coach, specific to one SI coach, but are consistent regardless of who is in the coach position."

J) Related Recommendations

An increase in funds, preferably from a stable funding source, for SI in biology courses would, it is anticipated, increase success and retention. At an anticipated cost of $2000 per SI coach, the total for coverage of 5 courses would be $10,000. Nancy Freeman's experience with SI in Biology 10 over the years (more than 5) has demonstrated this, and her data in the section above supports this conclusion.

SECTION 3
Curriculum

Review and discuss the curriculum work done in the program during the past four years, including the following:

A) Curriculum Course Review Timeline: 6-Year Cycle

In the 2019-2020 Course Catalog, there are 15 different offerings, counting standard and Honors-designated sections. This reflects a breadth of courses within the non-majors (including general biology, field studies, and environmental biology courses), majors, and independent study realms. The timeline below reflects course reviews every 6 years. This timeline includes adjustments that were recently made to several courses, such as Biology 101, 102, and 103 being reviewed to reflect updates in other areas. For example, the creation of Chemistry 4H required a rewrite of sections of the Biology courses in part to reflect that requirement's addendum of students' eligibility to take either CHEM 4 or CHEM 4H to meet the requirement for taking courses in the majors biology series (notably, Biology 101 or Biology 101H). This course review cycle has had several adjustments and impacts from the Campus Curriculum Committee (CCC), and Natural Sciences Division Curriculum Committee (DCC). Courses have sometimes been reviewed, and then reviewed again and updated before a 6-year cycle. This has occurred with the implementation of the Honors sections. There have also been impacts in recent years from staff turnover across the campus, such as at CCC or the Office of Academic Affairs, notably the departure of the Campus Curriculum Chairperson. Most recently, the software/database to use for curriculum development, maintenance, and monitoring was put on hold. CurricUNET was deactivated by Fall 2018; past courses appear to be accessed as Read-Only. A new program, called Curriculog, will not ready until at least the start of the 2019-2020 academic year. Unless things change, the only courses for review in the 2019-2020 year are Biology 17, Marine Biology, and the separate course Biology 18, Marine Biology Laboratory.

		Previous/Current Course Review	**Review-Next Cycle**	
Biology 8		2018-19	2024-25	
Biology 10		2015-16	2021-22	
Biology 10H		2015-16	2021-22	
Biology 11		2018-19	2024-25	
Biology 12		2018-19	2024-25	
Biology 15		2015-16	2021-22	
Biology 16		2015-16	2021-22	
Biology 17		2019-20	2025-26	
Biology 18		2019-20	2025-26	
Biology 99		2015-16	2021-22	
Biology 101		2018-19	2024-25	
Biology 101H		2018-19	2024-25	

		Previous/Current Course Review	Review-Next Cycle	
Biology 102		2018-19	2024-25	
Biology 102H		2018-19	2024-25	
Biology 103		2019-20	2025-26	

B) Course Additions to Current Course Offerings

There are no additions to the current course rotation of the last few years. Some courses are offered once per academic year, such as Biology 11, Fundamentals of Zoology, and Biology 12, Field Zoology, in the fall. The majors course, Biology 103, Fundamentals of Molecular Biology, and the non-majors courses such as Biology 8, Biology of Plants, Biology 17, Marine Biology, and Biology 18, Marine Biology Laboratory, are offered only in the spring.

C) Deletions and Inactivations from Current Course Offerings

In the 2015 Program Review, the course list included two classes designed for concepts, skills, and training in biotechnology that could lend itself to employment within the industry. Those courses, Biotechnology 1 and Biotechnology 2, were not offered within the current revaluation period. The two courses were supposed to be reviewed September 2015. According to the last accessible record in CurricUNET, they were labeled "Active" with a Last Board Approval Date of January 2018. This is not consistent with a planned inactivation discussed with the division dean near the scheduled review. They are not offered in the current course catalog and *this* is consistent with the inactivation of both courses. In order to keep the courses on the schedule, the college would need to 1) tolerate courses with low enrollment numbers and 2) increase the supply budget to accommodate the implementation of the content. The college did not see these considerations as priorities, and they were inactivated.

D) Courses and Number of Sections Offered in Distance Education

We are just starting to offer sections of hybrid or online courses. Several faculty members have already passed the training or are in the process of training with the campus Online Training Certification for the El Camino College course management system, CANVAS. This required faculty training enables opportunities for diverse teaching modalities and diversifies student access and enrollment options. While in general, Biology Program faculty members are in favor of face-to-face courses, particularly with the laboratory component, the chance to offer hybrid courses such Biology 10, Fundamentals of Biology, and the potential for the development of Biology 8, Biology of Plants, is appealing. This would provide an opportunity to reduce the challenges of limited class space by only requiring the meeting times for laboratory activities. At present, the 2019-2020 course catalog lists two hybrid sections of Biology 10 (sections BIOL 10-4852 and BIOL 10-4853). Another course being investigated for an on-line offering at least once a year, to go along with several face-to-face sections, is the lecture-only Biology 15, Environmental Aspects of Biology. At least two full-time faculty members are looking to

implement and offer sections either in the general academic year, and/or during winter and summer intersessions. Ideally, a pilot run of this online course would begin by Summer 2020, if not before.

E) Courses, Degrees, and/or Certificates: Students' Transfer or Career Training Needs

1. Have all courses that are required for your program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?

Yes, all courses have been offered during the last two years. We have a strong success in transfer to many CSU and UC campuses. Students have a rigorous course-load both within our department as well as other Natural Science disciplines that are an integral part of a biology-related academic pathway. Chiefly, these are courses in chemistry and physics. Courses offered each semester are Biology 10, 101, and 102. Those courses offered either fall or spring are enumerated in B) above.

2. Are there any concerns regarding program courses and their articulation to courses at other educational institutions?

Sometime in the last two academic years, a problem or lack of understanding arose with the articulation/admissions staff at UC Santa Barbara (UCSB). For a short window of time, UCSB suddenly was the only UC not accepting the status and course details of our Biology 101 courses. The courses are a part of the majors series, and, consequently, the whole series was not accepted for articulation. Biology 101 and 101H were retooled to more explicitly state the course content (i.e. greater elaboration of our Evolution material). Along with input and follow-up from the El Camino College Articulation Officer, and the new team of campus curriculum staff, these issues were resolved, and UCSB now accepts Biology 101 and 101H, along with the rest of the biology majors series.

3. How many students earn degrees and/or certificates in your program? Set an attainable, measurable goal related to student completion of the program's degrees/certificates.

Currently, students may earn AS degrees either in Biology or General Science. A Biology AS-T is not offered. For data relating to degrees, the following was provided by Institutional Research and Planning: 23 degrees in 2014-15, 20 degrees in 2015-16, 15 degrees in 2016-17, and 32 degrees in 2017-18. Transfers are also a measure of success. Many students attend ECC to gain preparation for transfer, not for an end goal of earning a degree (an AS degree has very limited employment potential). The goal for an overwhelming majority of students is a Bachelor's degree at a 4-year university. There were 21 transfers in 2014-15, 17 transfers in 2015-16, 12 transfers in 2016-17, and 25 transfers in 2017-18. With improvements in student support and financial aid, it is expected that increases in degrees and transfers will occur. Numerical goals are difficult to set, however, as a multitude of variables play into student success in degree attainment and/or transfer.

Certificates do not exist within our biology program. However, the biology faculty members have discussed the development of a certificate for individuals interested in fish and wildlife occupations.

4. Are any licensure/certification exams required for program completion or career entry? If so, what is the pass rate among graduates? Set an attainable, measurable goal for pass rates and identify any applicable performance benchmarks set by regulatory agencies.

We do not have any major licensing or certification exams to pass and earn our degrees. Some courses we offer do help students to complete a list of requirements for certain government agencies at the county, state, and/or federal levels, including the Los Angeles County Weights and Measures, the CA Department of Fish and Wildlife, the US Department of Fish and Wildlife, and the US Department of Interior. Since the enrollment of students in this category is relatively small (typically less than 20 students per academic year), it is not clear how we could "set a benchmark" goal or ideal count. No students preparing for these government agency careers has ever failed to pass the courses (notably Biology 16, Field Entomology, and Biology 8, Biology of Plants) over at least the past two cycles of Biology Program Review.

F) Related Recommendations

A recommendation our department has considered and is taking steps towards is seeking out the benefits and implementation of a few more online or hybrid courses as described above. This could help, in part, to diversify the options for students in their ability to access our courses. Also, it is a way to reduce the impact on our limited class space especially for courses with a laboratory component. In the last calendar year, administrators within the Natural Sciences Division and from across campus suggested this very solution to help our students. An analysis must take place of how, where, and with what frequency should the Biology Program contribute to these Distance Education opportunities. Monetary costs associated with the development of online or hybrid courses are not anticipated.

SECTION 4
Assessment of Student and Program Learning Outcomes (SLOs & PLOs)

A) Biology Program Level and Course Level Learning Outcomes (Appendix A: Alignment Grid)

Biology Program Learning Outcomes (PLOs):

PLO #1 Scientific Method: The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
PLO #2 Tools: The student will master the use of appropriate biological tools and evaluate evidence gathered to explain biological principles.
PLO #3 Content Knowledge: Students will have a working knowledge of biological principles and a mastery of a broad set of factual biological knowledge concerning ecology, evolution and cells.

Biology Course Level Student Learning Outcomes (SLOs):

Biology 8 – Biology of Plants
1. Scientific Method
2. Tools
3. Content Knowledge (Energy Flow)

Biology 10/10H – Fundamentals of Biology
1. Scientific Method
2. Tools
3. Content Knowledge (Mitosis)

Biology 11 – Fundamentals of Zoology
1. Scientific Method
2. Tools
3. Content Knowledge (Mitosis)

Biology 12 – Field Zoology
1. Scientific Method
2. Tools
3. Content Knowledge (Energy Flow)

Biology 15 - Environmental Aspects of Biology
1. Scientific Method
2. Content Knowledge (Energy Flow)
3. Content Knowledge (Materials Cycling)

Biology 16 - Field Entomology
1. Scientific Method
2. Tools
3. Content Knowledge (Dichotomous Keying)

Biology 17 - Marine Biology
1. Scientific Method
2. Content Knowledge (Energy Flow)
3. Content Knowledge (Materials Cycling)

Biology 18 – Marine Biology Laboratory

1. Scientific Method
2. Tools
3. Content Knowledge (Energy Flow)

Biology 101/101H – Principles of Biology I

1. Scientific Method
2. Tools
3. Content Knowledge (Energy Flow)

Biology 102/102H – Principles of Biology II

1. Scientific Method
2. Tools
3. Content Knowledge (Mitosis)

Biology 103 – Fundamentals of Molecular Biology

1. Scientific Method
2. Content Knowledge (Central Dogma)
3. Content Knowledge (Control of Gene Expression)

Course Level SLO Statements:

Scientific Method – The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.

Tools – The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.

Content Knowledge (Mitosis) – The student will be able to describe key activities in cell replication.

Content Knowledge (Energy Flow) – Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.

Content Knowledge (Materials Cycling) – Students will describe how biologically significant materials move between the biotic and abiotic components of an ecosystem and the role living things play in the cycling of these nutrients.

Content Knowledge (Central Dogma) – The student will be able to provide a detailed explanation of how the unit – by- unit transfer of genetic information occurs from DNA to RNA to Protein.

Content Knowledge (Control of Gene Expression) – The student will be able to explain various prokaryotic and eukaryotic gene expression control mechanisms.

Content Knowledge (Dichotomous Keying) - The student will be able to determine the identity of common insects to order by applying knowledge of insect anatomy and using a dichotomous key.

B) Timeline for Four Year Cycle: Course and Program Level SLO Assessments (Appendix B: Timeline Grid)

2019 – Biology Program Review

2020 – Spring

-Course Level SLO #1 Scientific Method: Biology 8, 10/10H, 15, 16, 17, 18, 101/101H, 102/102H, and 103

Fall

-Course Level SLO #1 Scientific Method: Biology 11 and 12

-Biology PLO #1 Scientific Method

2021 – Spring

-Course Level SLO #2 Tools (Microscope): Biology 8, 10/10H, 16, 18, 101/101H, and 102/102H

-Course Level SLO #2 Content Knowledge (Energy Flow): Biology 15 and 17

-Course Level SLO #2 Content Knowledge (Central Dogma): Biology 103

Fall

-Course Level SLO #2 Tools (Microscope): Biology 11 and 12

-Biology PLO #2 Tools/Content Knowledge

2022 – Spring

-Course level SLO #3 Content Knowledge (Mitosis): Biology 10/10H and 102/102H

-Course level SLO #3 Content Knowledge (Energy Flow): Biology 8, 18, and 101/101H

-Course level SLO #3 Content Knowledge (Material Cycling): Biology 15 and 17

-Course level SLO #3 Content Knowledge (Dichotomous Keying): Biology 16

-Course level SLO #3 Content Knowledge (Control of Gene Expression): Biology 103

Fall

-Course level SLO #3 Content Knowledge (Energy Flow): Biology 12

-Course level SLO #3 Content Knowledge (Mitosis): Biology 11

-Biology PLO #3 Content Knowledge

2023 – Biology Program Review

C) SLO and PLO Assessment Results and Descriptions of How Results led to Improved Student Learning with Specific Examples

The Biology Program has completed a full SLO and PLO assessment cycle as of Spring Semester 2019. The Biology Program includes 12 different courses taught by a combination of 8 full-time faculty members and 14 different instructors hired on a part-time basis. Data was collected from as many as 764 students enrolled in the 12 different courses offered by the Biology Program. Some key findings have been identified by the biology faculty members and this information has been used to inform instruction, equipment, and the assessments.

PLO #1: Scientific Method

Important key findings from this assessment identify differences in achievement between our non-majors students and our majors students. Overall, the standard was not met by the program but that was heavily influenced by the large number of students in our non-majors courses. Course level SLO results suggest our majors students are achieving the success targets but our non-majors students are achieving at a level below our 70% success target. We have discussed differentiating the assessment for our majors courses to evaluate a deeper understanding of the Scientific Method learning outcome. One consistent area of the scientific method process that all faculty agree is the weakest area of understanding across all biology courses is the students' ability to analyze data and use it to evaluate hypotheses. As a result, we are holding Biology Brown Bag meeting sessions to share and discuss instructional materials that allow students opportunities to evaluate evidence such as case studies, labs that involve data gathering and analysis, and the use of current topics relevant to student lives that involve biological evidence and implications to daily life. This finding was reflected in the latest revision of the Bio 10 lab manual that included two case studies. Our majors students are involved in authentic experimental design, data gathering and evidence-based conclusions throughout their course sequence. It would be beneficial to our non-majors students if we can find opportunities for them to participate in authentic evidence evaluation in which they form their own conclusions to questions relevant to their lives. Many instructors are looking for ways to make room for this type of inquiry by exploring the flipped classroom model.

PLO #2: Tools

Overall the Biology Program met this achievement standard. This is due in large part to the purchase of new microscopes for all our biology lab classrooms. This was accomplished through a commitment of funds over a period of three years. Our division has set aside funding to ensure that the new microscopes are maintained in good working order to support our students' success in this area. Faculty have discussed best practices in teaching novice students how to use this equipment to ensure they are experiencing success in learning to use this important tool as well as to keep the microscopes in good working condition. Signage in the lab classrooms has been prepared to help ensure students are handling the equipment properly and using it correctly. New lab manual diagrams have been included to reflect the current microscope designs and instruction appropriate to these specific microscopes.

PLO #3: Content Knowledge

Student knowledge of significant biological principles and facts was assessed in each of the courses within the Biology Program. Most of the biology courses, 10 of the 12 courses, reported successful achievement of the individual course content knowledge assessed. However, Biology 10 and Biology 15 did not achieve their assessment targets. The Biology 10 student population represents the largest portion of the students assessed in the Biology Program and includes students with the least experience with biology content. So, while most courses were successful in meeting their standard, the program overall did not. There are six different specific content knowledge subjects that are course specific and appropriate to the course content. In evaluating student achievement of diverse topics, a few common areas of need stood out to the faculty. Students have difficulty understanding key biological content that they can't see. For example,

when students are learning about cell metabolism, they don't connect the chemical symbols used to represent molecules involved in energy transformations to the words for those same molecules. They may know the name carbon dioxide but don't recognize the chemical symbol CO_2. In yet another example, they may be misunderstanding the steps of mitosis in cell division because they are looking at cells fixed in time and position and don't realize these are steps in a process of change. Much of biological content is smaller than the eye can see, and students may be confused by the indirect evidence, the symbolism, or the models and diagrams meant to be instructive.

D) Improvement of SLO/PLO Assessment Process and Engagement in Dialogue about Assessment Results

The Biology Program has achieved Sustainable Continuation of Quality Improvement through the SLO process. We have established a complete set of achievement standards for each course. These SLOs have been aligned to the Program Learning Outcomes and the Institutional Learning Outcomes for El Camino College. For every biology course, the instructor communicates these SLOs to the students in the course syllabus. Each biology course SLO has been assessed during this assessment cycle and the data has been used to inform change to instruction, materials, and resources. During this assessment cycle our biology faculty changed in significant ways. Important faculty retired and new faculty were hired. Some of our current courses reflected the interests and expertise of the retiring faculty members. These courses have been taught by our part-time faculty or full-time faculty periodically depending on schedule needs and preferences. As a result, it has been difficult to maintain continuity which was apparent in the SLO implementation. SLOs assessment for these courses did not always follow the timeline and it was difficult to evaluate results when the full-time faculty did not actually teach the course that was being evaluated. It may be important to evaluate the courses we offer and the faculty we have hired to teach them in order to maintain excellence in our Biology Program and continuity of our program goals.

E) Related Recommendations

i) Continued participation in professional development that introduces faculty members to new methodologies and tools for improvement of instruction is essential. Costs associated with this recommendation encompass those associated with travel, lodging, meals, and registration for professional conferences. These are variable. Other professional development activities are free of charge. A funding mechanism for coverage of the former would be ideal.

ii) Continued dialog on and, incorporation of, methodologies and tools that increase content understanding should happen. Monetary costs are not associated with this recommendation.

SECTION 5
Analysis of Student Feedback

Provide a copy of any feedback reports generated by Institutional Research and Planning or your program. Review and discuss student feedback collected during the past four years including any surveys, focus groups, and/or interviews.

A) Results of the Student Survey

During the Spring 2019, students in all the biology sections were surveyed in four areas: 1) Student Support, 2) Curriculum, 3) Facilities, Equipment, and Technology, and 4) Program Objectives. The following represents the statements/questions posed and the students were asked to answer one of the following ways: Strongly Agree, Agree, Neither Agree or Disagree, Disagree, or Strongly Disagree. Students were invited to participate in a Qualtrics survey via email (743) or anonymous link (67). There were 449 responses. This represents a response rate of 55.4%, which represents an improvement over the 29.7% response rate from the previous evaluation period. 77.1% of students were not biology majors (mostly Biology 10 students), while 22.9% said that they were biology majors. Of the non-major students, roughly 60% were from Behavioral and Social Sciences, Business, and Fine Arts disciplines.

Student Support

1) Instructors in this program helped me achieve my academic goals.
    -85.8% of students Strongly Agree or Agree.
2) Instructors in this program have been helpful when I have approached them with academic concerns.
    -88.1% of students Strongly Agree or Agree.
3) Instructors in this program provide opportunities to actively participate in my classes.
    -88.7% of students Strongly Agree or Agree.
4) Instructors in this program provide an adequate number of office hours.
    -83.2% of students Strongly Agree or Agree.
5) Instructors in this program are available when I go see them during office hours.
    -73.5% of students Strongly Agree or Agree.
6) I have felt a sense of community within this program.
    -74.8% of students Strongly Agree or Agree.
7) Student contributions have been valued by instructors in this program
    -84.2% of students Strongly Agree or Agree.

Analysis: Students generally felt that they are supported by the faculty members within the program. 88.7% of respondents felt that they were provided a chance to actively participate in class. The lowest score of 73.5% is for "Instructors in this program are available when I go see them during office hours". For this statement, 25.3% of respondents did not agree or disagree, which suggests that there is a group of students that do not utilize office hours and are neutral in their opinion.

Additional questions within this area are as follows:

8a) Do instructors in this program provide information on successful study approaches?
-89.6% of students said YES.
-10.4% of students said NO.

8b) If you answered YES, check all that apply (percent of those that said YES listed below):

Active Reading – 18.2%
(i.e. summarizing asking questions, summarizing points, explaining what was read to others)
Rewriting Class Notes – 13.0%
Self-Testing – 13.5%
Spacing Out Studying – 8.9%
Connecting Course Content – 14.9%
Reviewing Material Regularly – 19.4%
Effective Study Groups – 12.2%

8c) Have you used these study approaches in your classes?
-87.6% of students said YES.
-12.4% of students said NO.

Analysis: Students felt that instructors provided varied strategies for success in their studies and most did indeed employ those strategies in their classes. This discussion with students on study approaches should continue and expand to encompass additional approaches moving forward.

1. Curriculum

1) There is an appropriate range of courses offered in this program.
-78.2% of students Strongly Agree or Agree.
2) Courses were scheduled on days and times that were convenient to me.
-75.6% of students Strongly Agree or Agree.
3) I've been able to register for the classes I need within this program.
-85.6% of students Strongly Agree or Agree.
4) The courses in this program have helped me meet my academic goals.
-85.3% of students Strongly Agree or Agree.
5) There is a variety of extracurricular activities related to this program on campus.
-50.2% of students Strongly Agree or Agree.
6) The library has the resources to help me succeed in this program.
-49.7% of students Strongly Agree or Agree.
7) I actively participate or have participated in tutoring when available.
-36.3% of students Strongly Agree or Agree.

Analysis: Over 75% of respondents felt that the program adequately provided courses and course availability to help them meet their academic goals. However, the support beyond the classroom was inadequate. Roughly half the respondents believed there were adequate extracurricular activities related to the program on campus and enough library resources to support their endeavors. Only 36% of the responding students took advantage of tutoring when

available. 22% of students disagreed with the statement “I actively participate or have participated in tutoring when available”. 34% of students neither agreed nor disagreed. This result suggests that students do not take advantage of tutoring in large numbers. Increased overall support can occur with increased visibility of and involvement in club activities (Science, Pre-Med, Environmental and Horticulture), increased access to course textbooks at the library, and increased exposure to tutoring services. Supplemental Instruction (SI) is successfully offered in Biology 10. The cost for each course is approximately $1,800. The Supplemental Instruction Office would also require additional financial support to expand services. There is a current effort to increase SI in other biology courses with funds from the Guided Pathways Initiative. Face-to-face tutoring in biology has not been utilized in large numbers when available and it is highly dependent on finding qualified tutors in a consistent fashion. Efforts must be re-doubled to make students aware of what they can take advantage of to assist them with their course work, but they too must take the initiative to seek assistance when they require academic support.

Additional questions within this area are as follows:

8a) Would you enroll in winter session courses if offered?
-64.4% of students said YES
-35.6% of students said NO

8b) Would you enroll in summer session courses if offered?
-70.9% of students said YES
-29.1% of students said NO

9a) During which part of the day would you prefer to take classes?
-63.1% of students said MORNING
-27.5% of students said AFTERNOON
- 9.4% of students said EVENING

9b) If MORNING, what is the earliest you are willing to begin?
-16.4% of students said 7am
-35.7% of students said 8am
-48.0% of students said 9am

9c) If EVENING, how late are you willing to end?
-77.2% of students said 9pm
-13.6% of students said 10pm
- 9.2% of students said 11pm

Analysis: A significant percentage of students queried said they would take winter and/or summer sessions if offered. Our winter session returned to the schedule several years ago after it had been eliminated. This return to the schedule was positively received and it is hoped that winter offerings will continue moving forward. Many students surveyed would also like to start at 8 or 9am (no earlier) and end their evening courses no later than 9pm. Such responses should be instructive when considering class scheduling. However, classroom availability is a plausible limitation.

2. Facilities, Equipment, and technology

1) The buildings and classrooms used by this program are satisfactory.
   -87.6% of students Strongly Agree or Agree.
2) I am satisfied with the equipment (projectors, screens, microscopes, etc.) used in this program.
   -88.0% of students Strongly Agree or Agree.
3) I am satisfied with the computers and software used in this program.
   -74.7% of students Strongly Agree or Agree.
4) I am satisfied with Wi-Fi connectivity available in this program's buildings, classrooms and labs.
   -63.0% of students Strongly Agree or Agree.

Analysis: Generally, the respondents felt the classrooms and labs, equipment, and instructional tools were adequate. 63% of students felt that Wi-Fi connectivity was adequate. This is a considerable improvement over the last evaluation period where only 40% of students surveyed believed it to be adequate. Wi-Fi connectivity can still be inconsistent, but improvements have occurred.

3. Program Objectives

1) I am aware of the course outcomes - what I should be able to learn and what skills I should possess after completing courses in the program.
   -92.6% of students Strongly Agree or Agree.

Analysis: Over 90% of respondents believed the program is doing an adequate job of making them aware of the course outcomes. Much of this awareness occurs with the distribution and discussion of biology course syllabi that contain course outcomes, and reinforcement of the outcomes during class and lab sessions.

B) Implications of the Survey Results

The survey reveals that students feel they are supported by the program faculty members, believe the infrastructure is adequate, and are clear about the program objectives. Regarding curriculum, the courses offered, and availability generally support academic goals. Most students surveyed would take winter and/or summer session courses, if offered, with reasonable start (8am) and end times (9pm) for any course offered throughout the academic year.

C) Results of other Relevant Surveys

A question from the current survey (as there no other surveys from the 4-year period) that provides some insight into nonacademic work requirements our students handle is as follows:

How many hours do you work outside your academic work?
   -28.6% of students said they work 0-5 hrs./week
   -28.8% of students said they work 6-15 hrs./week
   -15.4% of students said they work 16-20 hrs./week
   -27.2% of students said that they work more than 20 hrs./week

Analysis: Approximately 40% of students surveyed work 16 or more hours per week. This is a significant amount of time not spent on academic work. The number of hours in nonacademic work impacts academic load and suggests careful consideration by counseling and other support programs when assisting students with educational plans and semester schedules. Students need to do well (As or Bs), not just pass with Cs. For example, majors biology students must have excellent academic records as they are required for competitive professional school and graduate school programs. A "Cs earn degrees" mentality must not take hold. If fewer courses per semester increases the probability of stronger grades (because of more study time), then this should be a consideration for those students wishing to pursue professional school and graduate school programs.

D) Related Recommendations

i) Continue to provide approaches for academic success, including encouraging students to attend office hours and tutoring, when available, for assistance with course content.

ii) Consider reasonable course start and end times.

iii) Refer students to counseling, financial aid, and support programs to remedy barriers to academic success.

Monetary costs are not associated with these recommendations.

SECTION 6
Facilities and Equipment

A) Existing Program Facilities and Equipment

The Biology Program makes very effective use of its facilities, which includes three laboratory classrooms (LS 105, NATS 127 and NATS 129), one lecture classroom (LS 108), and two preparatory labs (LS 111 and NATS 125) utilized primarily by three laboratory technicians. The laboratory classrooms rooms are scheduled to full capacity. The future growth and quality of the program is most impacted by the lack of space. While construction of additional facilities is not currently practical, one way to facilitate student demand would be to develop additional online and/or hybrid courses beyond Biology 10 (see Section 3, Curriculum). One consistent request has been the purchase of a greenhouse and ancillary equipment. In addition to plants already a part of the ECC landscape, and resources from laboratory technicians and instructors, the greenhouse is viewed as a cost-reducing and space-freeing action (the initial cost of the greenhouse notwithstanding) so that the laboratory preparatory room areas are not covered in plants for one-third to two-thirds of a given semester. As for requests from the 2015 Program Review, chairs for two of the lab classrooms (NATS 127 and 129) have been replaced. Laboratory rooms are equipped with microscopes (compound and stereoscopes) and additional equipment to carry out experiments. The current microscopes in LS 105 are replacements and reflect requests made during the last program review. These microscopes are larger than the previous ones. Consequently, the storage cabinets are too small, and these scopes cannot be stored properly. This has raised a safety concern. The compound microscope sits on the stage of the stereoscope. This increases the risk that a microscope will fall out of or be inappropriately removed from the cabinet. An injury to a student is a plausible consequence. This is unacceptable. New cabinets will need to be purchased or constructed. Several equipment items required to carry out experiments (i.e. incubators, water baths, lab freezer) are used constantly. Heavy use and aging parts increase instances of malfunction. These will need to be replaced as needed.

B) Immediate (1-2 years) Needs: Facilities and Equipment

Provide a cost estimate for each need and explain how it will help the program better meet its goals.

i) The replacement of the microscope cabinets in LS-105 is imperative. Having students remove and replace microscopes from the current storage cabinets not only increases the chance of the microscopes getting dropped or damaged, but it also presents a hazard as microscopes can fall and hurt students. This is a critical need and a safety concern. Microscope use is significant in the majors courses. Without microscopes, the quality of instruction is severely impacted. Prefabricated or custom build cabinets from an external company are options. The cost covers the manufacturing and installation of the cabinets (taxes, S and H covered as well). Approximate cost: $6,500 (18 cabinets @ $360 per cabinet; 2 microscopes per cabinet).

ii) If microscopes are damaged because of improper storage in LS 105, they would need to be replaced at a cost of $1,000 each. There are 36 microscopes that must be stored properly. The microscope replacement cost may be significant per year.

iii) Maintenance and Repair of Microscope Inventory (LS 105, NATS 127, NATS 129): $2,500/year (shared with anatomy, physiology, and microbiology sections)

iv) Maintenance and Repair of the Autoclave (LS 111): $8,100
This is required for the preparation of course materials, and sterilization of glassware and waste. This cost includes the purchase of a descaler.

v) Lab Freezer Replacement: $3,500
This required for storage of biological samples/materials.

vi) Benchtop Cabinet for Flammable Liquids (NATS 125): $1,200

vii) 20 Stereoscopes, Non-Majors Courses: $22,500

viii) 10 LaboMed Compound Microscopes, Non-Majors Courses: $10,600

ix) Insect Cabinets and Drawers: $5,000

C) Long-Range (2-4+ years) Needs: Facilities and Equipment

Provide a cost estimate for each need and explain how it will help the program better meet its goals.

i) Greenhouse and Ancillary Equipment: $110,000
The courses that would immediately benefit from this are Biology 8, Biology 10, and Biology 101/101H. These are all courses that cover plant-based content. Students would also benefit by having space to conduct research projects that emphasize the scientific process. Biology 102/102H students would indirectly benefit as counter space in LS 105 would be freed for equipment and activities. Consistent placement of materials and equipment on carts often presents a logistical nightmare and safety issue when classes are at capacity.

ii) Replacement of Equipment as Needed: $10,000
Hot plates, incubators, models, etc., are used heavily and the wear-and-tear necessitates replacement, when needed. Assessment of what is needed happens on a yearly basis and is incorporated in our yearly plans.

D) Specific Recommendations

i) Recommendations on maintenance, repair, and replacement of equipment are specified above. Detailed are $60,000 for the Immediate (1-2 years) Needs category and $120,000 for the Long-Range (2-4+ years) Needs category.

ii) The supplies required to run the courses in the Biology Program are extensive. A supply budget of $13,000 minimum (and shared with anatomy, physiology and microbiology sections) is required annually.

iii) The projector screen in NATS 129 needs to be repositioned to allow for increased access to the classroom whiteboard. This will require working with Facilities to initiate and complete the task. Monetary costs are not associated with this recommendation.

SECTION 7
Technology and Software

A) Adequacy and Currency of Technology and Software

All classrooms have equipment for instruction such as computers, audio-visual projectors, internet access, and licenses for software. It has been more than 5 years since computers and projectors have been replaced. The projector in the lecture room LS 108 does not work properly and it impedes the proper delivery of lectures, internet content, and video content from DVDs. It must be replaced, and multiple requests have been made to the Natural Sciences Division and Information Technology for repair and/or replacement. Regarding internet access, connectivity via hard-wired ports is consistent and Wi-Fi connectivity has improved. Localized classroom hotspots via access point modules should be considered when infrastructure improvements are considered and implemented. In addition to the equipment mentioned, a new Scantron machine in the faculty workroom (NATS 105) needs to be purchased. The existing machine is well over 10 years old and it behaves inconsistently. The printer in this workroom must also be replaced in addition to the printers (3) utilized by the technicians. Collectively, the printers are required for instructional and administrative purposes.

B) Immediate (1-2 years) Needs: Technology and Software

Provide a cost estimate for each need and explain how it will help the program better meet its goals.

i) For presentation of lectures, internet content, and video content from DVDs, computers and projectors will need to be replaced on a regular schedule. Such a schedule is not within control of the Biology Program. It is the responsibility of the Natural Sciences Division and Information Technology to set a schedule. It has been more than 5 years since replacements have occurred and we have immediate need for at least one projector (LS 108). Projectors are approximately $2,000. Computer replacement with monitor would be approximately $1,000 - $1,500 depending on the model.

ii) A new Scantron for the faculty workroom is required at a cost of $5,000.

iii) Four HP printers, one for the faculty workroom and three for the technician offices, are required at a cost of $1,300.

C) Long-Range (2-4+ years) Needs: Technology and Software

Provide a cost estimate for each need and explain how it will help the program better meet its goals.

For presentation of lectures, internet content, and video content from DVDs, computers and projectors will need to be replaced on a regular schedule. Such a schedule is not within control of the Biology Program. It is the responsibility of the Natural Sciences Division and Information Technology to set the schedule. It has been more than 5 years since replacements have occurred.

D) Specific Recommendations

i) The Division of Natural Sciences and Information Technology need to set a schedule for replacement of malfunctioning and/or aged equipment. Funds for such replacement need to be identified. Each projector is approximately $2,000 and each computer is $1,500 maximum.

ii) A new Scantron machine and four printers are, $5,000 and $1,300, respectively.

SECTION 8
Staffing

A) Program's Current Staffing: Faculty and Classified Staff

The following full-time faculty members teach the Biology courses with the Life Sciences.

Name	Reassigned time (how much in %)	Currently on leave (check)	Retired in last 2 years (check)	FT hired last 3 years (check)	Anticipated to retire in next 3 years (check)
Bryan Carey					
Nancy Freeman					√
Darcie McClelland	80% (for Academic Senate work)			√	
Jessica Padilla*					
Teresa Palos*					
Polly Parks*				√	
Karla Villatoro					

*Faculty members that also teach in the Life Sciences for the Allied Health disciplines.

It is anticipated that Nancy Freeman will retire June 2021. No other retirements are anticipated within the next three years. Nancy Freeman oversees instruction of the Biology 10 and Biology 10H non-majors general biology courses. These are highly impacted courses with approximately 30 sections offered each school year. Thus, hiring of a full-time instructor to replace Professor Freeman will be vital to maintaining the integrity of the non-majors biology program.

Currently, the majority of the non-majors field biology classes offered are staffed entirely by part time faculty members. This is an impediment to student success because part-time faculty members do not hold regular office hours and thus are not as available to students as full-time faculty members. This lack of extra support disproportionately hinders success of first generation and traditionally underrepresented in STEM student populations who are more likely to be underprepared and therefore need extra help to succeed in science.

	FTEF	FTEF FT	FTEF PT	FT/PT Load Ratio	FT/PT % Ratio	FTES
Fall 2015	8.93	4.85	4.08	1.18:1	54%/46%	187.10
Fall 2016	8.93	4.68	4.25	1.10:1	52%/48%	183.38
Fall 2017	9.28	5.78	3.50	1.65:1	62%/38%	184.19
Fall 2018	9.28	6.13	3.15	1.95:1	66%/34%	182.42

The FTES values throughout these last four years have been stable. This suggests that at present the department is adequately meeting student demand for course offerings, though instructors are still turning away many students from the high demand non-majors Biology 10 course. Thus, more sections of Biology 10 may be needed in the future to accommodate more students.

As of Fall 2019, we have 7 full-time and 9 part-time faculty members teaching biology classes. The FT/PT ratio decreased slightly from Fall 2015 to Fall 2016 as a result of the fact that Teresa Palos was on sabbatical, but has increased significantly since Fall 2016 due to her return and the hiring of 2 full-time faculty members, Darcie McClelland and Polly Parks, in 2016 and 2017, respectively.

Despite recent increases in FT/PT ratio, there is still an immediate need for a full-time faculty member to oversee the field studies courses as these courses are difficult and labor-intensive for students and require a significant amount of faculty mentoring and assistance outside of class. Staffing these courses with part-time faculty members who are not required to hold office hours negatively impacts the quality of the learning experience for students in a substantial way.

An adequate contingent of full-time faculty members is critical as they are able to maintain regular office hours and interact more often with students. This contributes to overall student success in the Biology Program, and especially impacts success of first generation and traditionally underrepresented in STEM student populations.

The Biology Program does not have an official mentoring program, but new faculty members are informally mentored by colleagues. This mentoring includes on-campus activities, field trips, conferences, and help with ECC policies and procedures. Recently, Nancy Freeman started a monthly brown bag meeting for faculty members to discuss best practices in scientific teaching and brainstorm about solutions to shared challenges. A formal mentoring program through the Faculty Development office is available to new faculty members.

Faculty members maintain currency in their fields by taking advantage of professional development opportunities (e.g. NSF sponsored workshops and faculty learning communities) and scientific journal/magazine subscriptions. Several faculty members actively participate in scientific societies.

There are three laboratory technicians that provide support. Cynthia Hoover is assigned to the non-majors courses, Christie Killduff is assigned to Biology 102, and Linda O'Hara is assigned to Biology 101. All contribute to the courses in the Life Sciences for the Allied Health disciplines.

B) Immediate (1-2 years) and Long-Term (2-4+ years) Needs: Staffing

Provide cost estimates and explain how the position/s will help the program better meet its goals.

Our immediate and long-term needs are two full-time instructors, one to specialize in instruction of non-majors field studies courses and one to address the near-future retirement of Nancy Freeman. Approximate Cost: $196,000 (pay and benefits/year). The discussion in A) above provides justification for the staffing recommendation.

C) **Specific Recommendations**

It is recommended that priority be given to the hiring of two full-time instructors, one to specialize in instruction of non-majors field studies courses and one to address the near-future retirement of Nancy Freeman. Approximate Cost: $196,000 (pay and benefits/year).

SECTION 9
Direction and Vision

A) Relevant Changes within the Academic Field/Industry

How will these changes impact the program in the next four years?

Biology faculty members who teach majors courses have been increasing emphasis on genetics and genomics concepts, as the number of jobs available to students whose studies include an emphasis in these fields are rapidly increasing and 4-year institutions have prioritized these specialties. For instance, Biology 101 professors are increasingly emphasizing the importance of genomic data for placing organisms into taxonomic groups while Biology 102 professors have been devoting additional time to topics such as epigenetics, genetic modification, genetic testing, and uses of genomic data for clinical purposes. Additionally, instructors have responded to prioritization of undergraduate research experience at 4-year institutions by encouraging students to participate in REU programs (Research Experiences for Undergraduates) and by changing the focus of the laboratory component of the Biology 102 course to place additional emphasis on practical molecular biology research techniques.

Though the field of biology is increasing shifting toward an emphasis on molecular biology, genetics, and genomics, the Biology Program cannot forget the importance of and demand for instruction in organismal biology. The Biology 16 course (Field Entomology) has in the past and will continue to address the critical need of the Los Angeles County Department of Weights and Measures. Employees of this county department are required to take an entomology course and our course is the only one taught at a community college in Los Angeles County. Other courses like Biology 8, 12, and 17 (Biology of Plants, Field Zoology, and Marine Biology, respectively) are important offerings that widen the range of our biology program and better prepare our students for careers at institutes such as museums, aquaria, and botanical gardens. Students with such preparation can also work with the US Fish and Wildlife Service and other government agencies. Ensuring that courses like Biology 8, 11, 12, 16, 17, and 18 are offered with high quality instruction is a priority.

B) Direction and Vision of the Program

The program faculty and other personnel are well aware of the present state of the program. Every semester, instructors must turn away students desiring non-major courses such as Biology 10 (non-majors Biology). Budget considerations are presented to faculty members and technical staff in order to solicit input for ways to best utilize existing and much needed supplies. Division council meetings and Life Science department meetings are regularly held and allow the program staff to participate in the planning of the program's future. Despite differences of opinion on varied issues, it must be noted that the Biology faculty members are more often than not a cohesive group that works well together and communicates effectively.

The program fulfills the college's mission very well and aligns with the following strategic initiatives:

- **Strategic Initiative A**: Support student learning using a variety of effective instructional methods, educational technologies, and college resources.
- **Strategic Initiative B**: Strengthen quality educational and support services to promote and empower student learning, success, and self-advocacy.
- **Strategic Initiative C**: Advance an effective process of collaboration and collegial consultation conducted with integrity and respect to inform and strengthen decision-making.
- **Strategic Initiative D**: Develop and enhance partnerships with schools, colleges, universities, businesses, and community-based organizations to respond to the educational, workforce training, and economic development needs of the community.
- **Strategic Initiative E**: Strengthen processes, programs, and services through the effective and efficient use of assessment, program review, planning and resource allocation
- **Strategic Initiative F**: Modernize infrastructure and technological resources to facilitate a positive learning and working environment.

C) Specific Recommendations

Over the next four years, funding mechanisms (State and otherwise) and administrative support must be explored for improved microscope storage, increased molecular biological activities in majors courses, and the acquisition of a small gardening area or greenhouse near the Natural Sciences building.

In recent years, a substantial investment has been made to replace the microscopes used for the laboratory courses in the majors biology series. However, current storage space is inadequate to accommodate the new microscopes, and this results in significant safety hazards for students and instructors as well as an increased likelihood that the microscopes may be damaged due to improper storage. Funding for new cabinets to properly store the microscopes is urgently needed to protect student safety and ensure best possible return on the investment made for the microscopes.

Revised majors courses will require increased funds to perform molecular biological activities in the laboratory component.

A small gardening area or greenhouse would allow for the growth and maintenance of botanical specimens. The greenhouse would also provide a controlled environment for the introduction of plant-based experiments/studies in our courses.

SECTION 10
Prioritized Recommendations

A) Prioritized list of recommendations and needs for the program/ department (drawn from recommendations in sections 2-8).

Cost estimates and college strategic initiatives that support each recommendation.

	Recommendations	Cost Estimate	Strategic Initiatives
1.	Microscope Storage Cabinets (LS 105)	$6,500	A, F
2.	Microscope Maintenance and Repair	$2,500/yr.	A
3.	Supplemental Instruction	$2,000/coach; $10,000 total (5 courses)	A, B
4.	Two Faculty Hires	$196,000/yr.	A, B, C
5.	Lab Supplies	$13,000/yr.	A
6.	Lab Freezer Replacement (LS 111)	$3,500	A
7.	Autoclave Maintenance (LS 111)	$8,100/yr. (includes descaler purchase)	A
8.	Replacement of Lab Equipment (as needed)	$10,000	A
9.	Repositioning of Projector Screen in NATS 129 (Facilities)	N/A-In-House	F
10.	Scantron Equipment (Faculty Workroom, NATS 105)	$5,000	A, B
11.	New Projector (LS 108)	$2,000	A
12.	4 Printers (1 Faculty Workroom, NATS 105, and Technician Offices)	$13,000	A, C
13.	Benchtop Cabinet for Flammable Liquid Storage (NATS 125)	$1,200	A
14.	Stereoscopes, 20, for Non-Majors Courses	$22,500	A
15.	LaboMed Compound Microscopes, 10, for Non-Majors Courses	$10,600	A
16.	Insect Cabinets and Drawers	$5,000	A
17.	Greenhouse and Ancillary Supplies	$110,000	A, F

B) Prioritization Explanation

The majority of recommendations directly support student learning. The first on the list also represents a safety concern. Improperly stored microscopes in cabinets that cannot accommodate them *will* lead to accidents that will hurt students. It is only a matter of time before we see this materialize. In addition to this consideration, damaged microscopes will necessitate replacement. This can be costly. Supplemental Instruction monies and faculty hires are ranked highly as the support for these within the Biology Program is strong and uncompromising. The rest of the recommendations mostly focus on equipment maintenance and replacement. Collectively, these recommendations are essential and have a direct impact on equity and student success.

NATURAL SCIENCES
Institutional (ILO), Program (PLO), and Course (SLO) Alignment

Program: **Biology**	**Number of Courses:** 11	**Date Updated:** 09.10.2014	**Submitted by:** T. Jim Noyes, ext. 3356

ILOs	**1. Critical Thinking** *Students apply critical, creative and analytical skills to identify and solve problems, analyze information, synthesize and evaluate ideas, and transform existing ideas into new forms.*	**2. Communication** *Students effectively communicate with and respond to varied audiences in written, spoken or signed, and artistic forms.*	**3. Community and Personal Development** *Students are productive and engaged members of society, demonstrating personal responsibility, and community and social awareness through their engagement in campus programs and services.*	**4. Information Literacy** *Students determine an information need and use various media and formats to develop a research strategy and locate, evaluate, document, and use information to accomplish a specific purpose. Students demonstrate an understanding of the legal, social, and ethical aspects related to information use.*

SLO-PLO-ILO ALIGNMENT NOTES:

Mark boxes with an 'X' if: SLO/PLO is a major focus or an important part of the course/program; direct instruction or some direct instruction is provided; students are evaluated multiple times (and possibly in various ways) throughout the course or are evaluated on the concepts once or twice within the course.

DO NOT mark with an 'X' if: SLO/PLO is a minor focus of the course/program and some instruction is given in the area but students are not formally evaluated on the concepts; or if the SLO/PLO is minimally or not at all part of the course/program.

PLOs	**PLO to ILO Alignment** *(Mark with an X)*			
	1	**2**	**3**	**4**
PLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X	X		X
PLO #2 Tools The student will master the use of appropriate biological tools and evaluate evidence gathered to explain biological principles.				X
PLO #3 Content Knowledge Students will have a working knowledge of biological principles and a mastery of a broad set of factual biological knowledge concerning ecology, evolution and cells.	X			X

SLOs	SLO to PLO Alignment (Mark with an X)			COURSE to ILO Alignment (Mark with an X)			
	P1	P2	P3	1	2	3	4
BIOL 10 Fundamentals of Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 10 Fundamentals of Biology: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 10 Fundamentals of Biology: SLO #3 Content Knowledge (Mitosis) The student will be able to describe key activities in cell replication.			X				
BIOL 101 Principles of Biology I: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 101 Principles of Biology I: SLO #2 Use of Microscope The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 101 Principles of Biology I: SLO #3 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X				
BIOL 102 Principles of Biology II: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 102 Principles of Biology II: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 102 Principles of Biology II: SLO #3 Content Knowledge (Mitosis) The student will be able to describe key activities in cell replication.			X				
BIOL 103 Fundamentals of Molecular Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 103 Fundamentals of Molecular Biology: SLO #2 Content Knowledge (Central Dogma) The student will be able to provide a detailed explanation of how the unit-by-unit transfer of genetic information occurs from DNA to RNA to Protein.			X	X	X		X
BIOL 103 Fundamentals of Molecular Biology: SLO #3 Content Knowledge (Control of Gene Expression) The student will be able to explain various prokaryotic and eukaryotic gene expression control mechanisms.			X				

SLOs	SLO to PLO Alignment (Mark with an X)			COURSE to ILO Alignment (Mark with an X)			
	P1	P2	P3	1	2	3	4
BIOL 11 Fundamentals of Zoology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 11 Fundamentals of Zoology: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 11 Fundamentals of Zoology: SLO #3 Content Knowledge (Mitosis) The student will be able to describe key activities in cell replication.			X				
BIOL 12 Field Zoology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 12 Field Zoology: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 12 Field Zoology: SLO #3 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X				
BIOL 15 Environmental Aspects of Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 15 Environmental Aspects of Biology: SLO #2 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X	X	X		X
BIOL 15 Environmental Aspects of Biology: SLO #3 Content Knowledge (Materials Cycling) Students will describe how biologically significant materials move between the biotic and abiotic components of an ecosystem and the role living things play in the cycling of these nutrients.			X				
BIOL 16 Field Entomology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 16 Field Entomology: SLO #2 Tools The student will be able to observe insects on compound and dissection microscopes.		X		X	X		X
BIOL 16 Field Entomology: SLO #3 Content Knowledge and Tools (Dichotomous Keying) The student will be able to determine the identity of common insects to order by applying knowledge of insect anatomy and using a dichotomous key.		X	X				

SLOs	SLO to PLO Alignment (Mark with an X)			COURSE to ILO Alignment (Mark with an X)			
	P1	P2	P3	1	2	3	4
BIOL 17 Marine Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X	X					
BIOL 17 Marine Biology: SLO #2 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X	X	X		X
BIOL 17 Marine Biology: SLO #3 Content Knowledge (Materials Cycling) Students will describe how biologically significant materials move between the biotic and abiotic components of an ecosystem and the role living things play in the cycling of these nutrients.			X				
BIOL 18 Marine Biology Laboratory: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 18 Marine Biology Laboratory: SLO #2 Tools The student will be able to use the compound and dissecting microscopes to observe cells and microorganisms.		X		X	X		X
BIOL 18 Marine Biology Laboratory: SLO #3 Content Knowledge (Energy Flow) The student will demonstrate how the principles of energy flow exist in relationships observed between autotrophs and heterotrophs in ecosystems.			X				
BIOL 8 Biology of Plants: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 8 Biology of Plants: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X		X	X		X
BIOL 8 Biology of Plants: SLO #3 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X				

APPENDIX B
SLO Timeline Grid

Each biology course has identified a specific set of SLOs that support the Biology Program-level SLOs. The assessment timeline is represented below:

T: Tools
SM: Scientific Method
CK: Content Knowledge

	Proficiency with a Microscope (T)	Scientific Method (SM)	Mitosis (CK)	Energy Flow (CK)	Materials Cycling (CK)	Dichotomous Keying (BT)	Central Dogma (CK)	Control of Gene Expression (CK)
Bio 8	Sp '21	Sp '20		Sp '22				
Bio 10/10H	Sp '21	Sp '20	Sp '22					
Bio 11	Fa '21	Fa '20	Fa '22					
Bio 12	Fa '21	Fa '20		Fa '22				
Bio 15		Sp '20		Sp '21	Sp '22			
Bio 16	Sp '21	Sp '20				Sp '22		
Bio 17		Sp '20		Sp '21	Sp '22			
Bio 18	Sp '21	Sp '20		Sp '22				
Bio 101/101H	Sp '21	Sp '20		Sp '22				
Bio 102/102H	Sp '21	Sp '20	Sp '22					
Bio 103		Sp '20					Sp '21	Sp '22

APPENDIX C
6-YEAR CURRICULUM COURSE REVIEW TIMELINE

Course		Previous/Current Course Review	Review-Next Cycle	
Biology 8		2018-2019	2024-25	
Biology 10		2015-2016	2021-22	
Biology 10H		2015-2016	2021-21	
Biology 11		2018-2019	2024-25	
Biology 12		2018-2019	2024-25	
Biology 15		2015-2016	2021-22	
Biology 16		2015-2016	2021-22	
Biology 17		2019-2020	2025-26	
Biology 18		2019-2020	2025-26	
Biology 99		2015-2016	2021-22	
Biology 101		2018-2019	2024-25	
Biology 101H		2018-2019	2024-25	
Biology 102		2018-2019	2024-25	
Biology 102H		2018-2019	2024-25	
Biology 103		2019-2020	2025-26	