**ANNUAL PROGRAM REPORT**

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|---|---|
| College | College of Science |
| Department | Biological Sciences |
| Program | B.A., B.S. and M.S. in Biological Sciences |
| Reporting for Academic Year | 2019-2020 |
| Last 5-Year Review | 2018-2019 |
| Next 5-Year Review | 2022-2023 |
| Department Chair | Brian A. Perry |
| Authors of Review | Brian A. Perry, Ana Almeida, Maria Gallegos |
| Date Submitted | October 1, 2020 |

## I. SELF-STUDY

### A. Five-Year Review Planning Goals

- *Increase student participation in the B.S. in Ecology and Evolutionary Biology (EEB) concentration*
- *Increase student opportunities in the B.A. in Biology Education concentration*
- *Increase student opportunities in the B.S. in Forensic Science concentration*
- *Increase enrollment in the M.S. in Biology graduate program*
- *Increase student success within the major as demonstrated by improved graduation rates and student retention*
- *Build community among the undergraduate and graduate populations through seminar series and research symposia*
- *Improve connections with our alumni*

### B. Progress Toward Five-Year Review Planning Goals

*Increase student participation in the B.S. in Ecology and Evolutionary Biology (EEB) concentration*

The department continues to foster interest and participation in our EEB concentration through the hiring of faculty that will offer courses, research opportunities and student mentorship in this area, continued participation with the Oakland Zoo to create student internship opportunities, and renewed student participation in the curation of our expanding natural history collections. Additionally, the department is in the process of developing student recruitment materials that can be more easily distributed in this period of distance learning. While it is difficult to get an exact count of EEB students currently in the department, Bay Advisor data indicates an increase of 13 to 37 actively enrolled EEB majors from Fall 2018 to Fall 2020 (existing students remaining in the quarter catalog equivalent of the EEB concentration are not included in these calculations). Of the 37 students currently in the concentration; 21 have entered the program as freshman since Fall 2018 (6-9 per year), and 16 are transfer students. Overall, EEB students make up approximately 5.8% of the actively enrolled students in the department, which is only slightly greater than the 3-5% that this concentration (i.e., option) historically accounted for under the quarter catalog. It is apparent the department has a significant task ahead of us to increase enrollment in this concentration.

*Increase student opportunities in the B.A. in Biology Education concentration*

The B.A. in Biology Education concentration currently accounts for approximately 7.7% of actively enrolled biology majors. Although this may seem a small amount, the size of the concentration has been increasing annually by 44-112% since Fall 2018. As indicated in the 5-Year review, this is a concentration with growing demand around the country, and CSUEB has the potential to develop a very strong

program. As the department's science education specialists, Dr. Erica Wildy and Dr. Caron Inouye were the driving force behind the Biology Education concentration. With the move of Dr. Inouye into an administrative position, and Dr. Wildy also assuming more administrative roles, it will be necessary for the department to again request the hiring of a Science Education Specialist. The department has requested such a hire in previous reports.

*Increase student opportunities in the B.S. in Forensic Science concentration*
The B.S. in Forensic Science concentration continues to grow, and currently accounts for approximately 13.1% of actively enrolled biology majors. Dr. Chris Baysdorfer, one of our cell and molecular biology faculty, has been the primary department member responsible for this concentration which is largely supported by courses that also utilized by the Cell & Molecular Biology concentration. With interest in the field continually increasing, however, it will be necessary to again request the hiring of a Forensic Scientist that can offer additional courses in this area and serve as a second departmental mentor for these students. The department has requested such a hire in previous reports.

*Increase enrollment in the M.S. in Biology graduate program*
Reduced enrollment in the graduate program continues to make it very challenging (or impossible) to offer a number of our graduate level courses, as they often do not meet the minimum class size requirement set by the College of Science. Dr. Maria Gallegos, the Graduate program Coordinator, and the Department Chair have been working with the College of Science Social Media Intern to create flyers and posters, as well a larger web and social media presence, to advertise the program in an effort to recruit more students. Posters for the graduate program were developed in Spring 2020, but due to the university closure these have not yet been printed or distributed. Several Instagram adds were run in Spring 2020, and we plan to run additional adds prior to the application period in Spring 2021.

*Increase student success within the major as demonstrated by improved graduation rates and student retention*
Data available via Pioneer Insights and the CSU Student Success Dashboard indicate that very few of our students graduate with 4 or even 6 years (11% and 47% on average, respectively), and that very few students that begin as Biology majors graduate with a degree in Biology (~25.7%). While there are numerous reasons why our students struggle academically, there are several steps the department has implemented in an attempt to improve these numbers.
Beginning in Spring 2021 the department will require mandatory faculty advising for students with a GPA of 2.5 or lower prior to enrolling in courses. This will allow us to ensure these students enroll in the proper courses and receive the academic support they need to improve their GPA.

The department has constructed detailed roadmaps that provide students with a pathway to compete the biology degree within 4 years (and 2 years for transfer students). These roadmaps are widely available on the department website and within the College of Science, and are currently being used by FAAST and AACE to advise incoming freshman and transfer students.

Because the University refuses to broadly enforce prerequisites during the class enrollment process, the department for many years simply allowed faculty to enforce course prerequisites as they saw fit. As a result, prerequisite enforcement was largely ignored which resulted in a large number of students enrolling in courses they were not prepared for. The consequences of this were elevated DFW rates and courses being taught at a lower-level to accommodate inadequately prepared students. With the move to semesters the department has made the commitment to strictly enforce course prerequisites by manually scanning course rosters and checking that every enrolled student meets the prerequisites.

While this results in a tremendous amount of work for the chair and administrative staff, we are confident that these efforts will have positive overall impact. It will be several years before the department can assess the effectiveness of these efforts to improve student success as measured by increased graduation rates and student retention.

*Build community among the undergraduate and graduate populations through seminar series and research symposia*

High-impact teaching strategies employed by the department include student involvement in both independent and whole-class research projects. In an effort to recognize and celebrate the research achievements of our students, and provide them with opportunities to polish their presentation skills, the department has been organizing an annual student research symposium that includes student presentations, poster session and a keynote address. All Biology students (both undergraduate and graduate) are encouraged to attend and participate. To date the department has offered two such symposia in Fall 2018 and Fall 2019, both of which were a great success with high student involvement. Unfortunately, the Fall 2020 symposium had to be cancelled due to the Covid-19 pandemic.

The department also continues to expand our monthly seminar series which provides our students with exposure to research at the academic and industry level by inviting faculty, postdoctoral associates and research scientists as speakers. Student attendance at the seminars remains high, and participation in a post-seminar lunch with the speaker continues to be positively evaluated. With the move to almost entirely online instructional format for the Fall 2020 and Spring 2021 semesters, the department has successfully transitioned the seminar series to virtual format.

*Improve connections with our alumni*

The department launched an Alumni Map project in Fall 2017 that already includes data for over 50 of our previous undergraduate and graduate students. The department continues to develop an online exit questionnaire so that we can assess where our students are going upon graduation and obtain contact information that will allow us to remain in touch with them once their university email addresses become inactivated. The department plans to develop a quarterly, electronic alumni newsletter that highlights the academic and research achievements of our students and faculty, and features profiles of our successful graduates.

**C. Program Changes and Needs**

Overview: The 2019-20 academic year started quietly and ended on a relatively chaotic note with the university shut down and abrupt transition to entirely online course delivery. Overall the Biology faculty, staff and students did a fantastic job given the circumstances. Significant personnel changes include the retirement of IST Sharon Horgan and ET Brian Sowers. The department was in the process of completing a search for a tenure track position in Integrative Biology, but unfortunately this search was closed when the CSU-wide hiring chill was initiated by the Chancellor's Office. The department continues to make excellent use of the research and mentoring space provided by the relatively new Small Animal Care and the Molecular Research Facilities. The department continues to have faculty, resource and space needs as we grow in both student and faculty numbers.

Curriculum: No significant curriculum changes to report.

Students: In Fall 2019 the department served 709 undergraduate Biology majors and 35 actively

enrolled graduate students. This was a 1.6% increase in our undergraduate student population since AY2018-19, and a 2.8% decrease in our graduate student population. During this same period undergraduate FTES in Biology increased from 472 in Fall 2018 to 499 in Fall 2019 (+5.7%), suggesting that more of our students are taking a full load of courses and that we continue to serve a large number of students outside the major. Enrollment in the graduate program has remained relatively consistent at 34-36 actively enrolled students over the past three academic years, but this number does not capture the true size of the program. Although only 35 graduate students were enrolled in courses and/or thesis units during the Fall 2019 semester, there were approximately 25 additional students who are done with all coursework and thesis units, but who continue to actively work with faculty. It is these latter students that demand a great deal of faculty time and support as they complete their thesis research, even if these students are not enrolled in courses or thesis units.

Student demographics remain effectively unchanged from the 5-Year review submitted in May 2019, and therefore will not be discussed further here.

Faculty: During AY 2019-20 the department initiated a search for a tenure-track position in Integrative Biology. The committee did an excellent and timely job of screening the applications and conducting phone interviews, but unfortunately the search was closed as part of the CSU-wide hiring chill days before we had planned to begin on-campus interviews. Fortunately, the position has been rolled-forward to AY 2020-21 and we will be completing the search this Fall.

Staff: During AY 2019-20 the department experienced two staff retirements. Both Sharon Horgan (IST-III) and Brian Sowers (ET-II) retired after serving the Department and College for a number of years. Sadly, Sharon Horgan passed away shortly after her retirement. The department was able to complete the hiring of Riffat Hussain (IST-II) to fill the vacant position created by Sharon's retirement before the hiring chill, but unfortunately our Equipment Technician position remains vacant. Given the expected uncertainty of the university budget over next few years, we fear this position may remain unfilled for an extended period. This situation creates an issue for both the Biological Sciences and Chemistry departments as both rely heavily on this position for equipment maintenance and repair. Natalie Granera (ASC-II) continues to do an excellent job managing the departmental office, with Kathy Palmer (ASA-II) serving as her administrative assistant. Due to the high volume of students requiring assistance from the office staff, we hired a work-study student in AY 2019-20 to assist with basic office tasks. The department also employs three additional ISTs (Annapurna Chandra, Blanca Ruiz and William Roan) that support our courses and manage the department stockroom.

Resources: The department continues to replace existing, aging equipment and add new equipment through the use of A2E2 and College of Science funds. However, great need still exists for additional equipment and resources required to offer our courses at a level deserving of our students.

The department continues to be "bursting at the seams" with regards to office and research space. Nearly all faculty in the department (tenure track and lecturers) currently share office space, and we have no available space in which to house all of our graduate teaching associates while they prepare for the courses they teach or hold office hours. All of the research space that has been allocated to the department is currently in use, and many research faculty must utilize classrooms (when available) to conduct their research. The completion of the Molecular Research Facility and Small Animal Care Facility have provided the department with desperately needed research and mentoring space, but with the hiring of Dr. Hazlehurst in Fall 2019 and expected start of another tenure-track faculty member in Fall 2021, all of the available research space currently allocated to Biology will once again be filled.

Assessment: The department continues to assess our program learning outcomes with slight modification - please see the "Recommendations for Program Improvement" section below. We have included a Summary of Assessment for both the undergraduate and graduate programs here.

Other: No significant program modifications to report.

## II-A. SUMMARY OF ASSESSMENT – UNDERGRADUATE PROGRAMS

**A. Program Learning Outcomes (PLO)**

*Students graduating with a B.S. or B.A. in Biological Sciences from Cal State East Bay will be able to:*

1. *Explain core biological concepts, including evolutionary processes, structure-function relationships across all levels of biological organization, homeostasis, information flow, matter and energy transformations, and the interactions and interconnectedness of living systems (ILO 6);*
2. *apply quantitative reasoning to explain biological phenomena and to address biological problems (ILO 1);*
3. *clearly communicate biological information in a variety of formats (written, oral, visual) using a style appropriate for the intended audience (ILO 1,2,6);*
4. *apply methods of scientific inquiry by formulating testable hypotheses, collecting and analyzing data, and reporting conclusions (ILO 1,6);*
5. *gather, interpret, and evaluate published scientific information (ILO 1,6).*

**B. Program Learning Outcome(s) Assessed**

B.S./B.A. Programs: According to our 5-year Assessment Plan, Year 2 Assessment focused on PLO2. In order to assess this outcome, the department participated in University ILO assessment of Quantitative Reasoning (ILO1). No other program learning outcomes were assessed for these programs during AY 2019-20.

**C. Summary of Assessment Process**

Instrument: For the University ILO Quantitative Reasoning (ILO1) Assessment, Dr. Ana Almeida provided a major assignment for BIOL 426 (Advanced Molecular and Cell Biology) to the members of the ILO Subcommittee. BIOL 426 is an upper division, senior-level course required course for the Cell and Molecular Biology concentration as well as a capstone course for the Forensic Science concentration.

Sampling procedure: Nine (9) student artifacts from BIOL 426 were randomly selected by the ILO Assessment Team for the purpose of the University ILO1 Assessment.

Data Collection: Dr. Ana Almeida assessed the 9 selected artifacts using the Senate approved ILO Quantitative Reasoning Rubric. Out of the 7 rubric categories (Problem Formulation, Representation/Visualization, Quantitative Analysis, Interpretation, Implications, Limitations, and Overall communication), data was collected for all categories except Quantitative Analysis. Dr. Ana Almeida has been a member of the ILO Subcommittee and has extensive experience in assessment of learning outcomes.

Data Analysis: Each category of the ILO Rubric was analyzed individually and compared to College of Science (CSCI)-wide results. The results shown in D (Summary of Assessment Results, Figures D1 and D2) include all nine BIOL 426 data points. Black solid horizontal lines represent the department averages. Gray boxes represent the first and third quartiles and black solid vertical lines represent the department

minimum and maximum. Horizontal dashed lines represent CSCI-wide averages for the ILO Quantitative Reasoning assessment, while green lines represent competent rubric scores (3).

**D. Summary of Assessment Results**

Main Findings: Figure D1 presents average scores for 6 out of 7 ILO Quantitative Reasoning Rubrics assessed using 9 artifacts from BIOL 426. For most of the evaluated ILO Quantitative Reasoning rubric categories, department averages were below competency, with the exception of *Representation/Visualization* and *Problem Formulation*. The worst departmental averages were observed in the *Implications* and *Limitations* categories. Interestingly, with the exception of *Limitations*, department averages were higher than CSCI averages for all other assessed categories. The lowest average score was observed in the category *Limitations* (2.22/5), closely followed by *Implications* (2.44/5). The best average scores were observed in the category *Representation/Visualization* (3.44/5), followed by *Problem Formulation* (3.11/5).

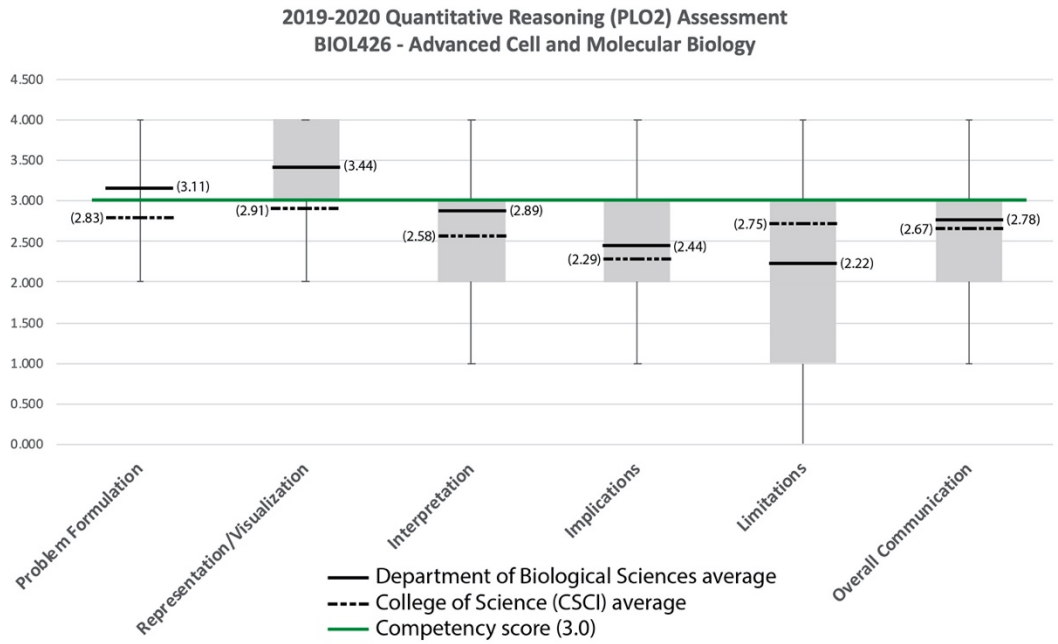



**Figure D1.** Average scores for 6 of the 7 ILO Quantitative Reasoning Rubric categories. Department of Biological Science averages (horizontal solid black, n = 9) are compared to College of Science (CSCI) averages (dashed lines, n = 108). Department and CSCI numerical averages are provided in parenthesis. Competency score is set at 3.0 for all categories (green horizontal line). Vertical lines denote Department minimum and maximum scores, while gray square highlights first and third quartiles.

BIOL426 student's average scores are shown in Figure D2. Three out of nine student's assessed artifacts scored above competency (students 1, 5 and 9). As exemplified by student's 2, 4 and 8, minimum and maximum scores varied extensively across rubric categories. Interestingly, all assessed artifacts exhibited competency in at least one category, since all maximum scores are at or above 3.

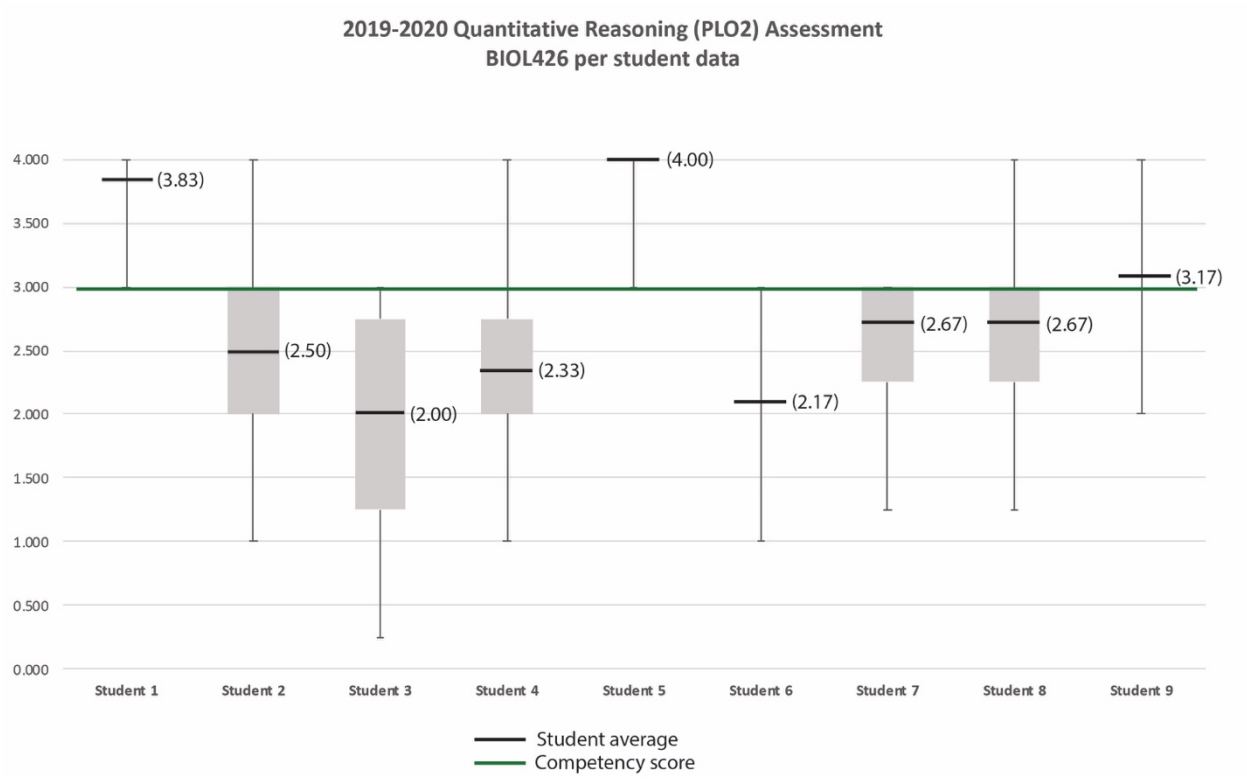



**Figure D2.** Average scores for each BIOL426 student. Department of Biological Science averages are shown on horizontal solid black and numerical averages are provided in parenthesis. Competency is set at 3.0 for all categories. Vertical lines denote department maximum and minimum student scores, while gray square highlights first and third quartiles.

Limitations: The results presented here, although interesting and somewhat informative, are limited by various factors. First, the assessment was only performed with nine artifacts and in the context of BIOL 426, potentially leading to a biased sampling of the Department's student population. Second, the assessment was based on student's answers to a course assignment, which was neither validated, not capable of addressing all 7 ILO Quantitative Reasoning rubric categories. Despite the fact that this assignment was reviewed by faculty of other Colleges across the University, as well as the Associate Dean of the College of Science, it was never properly validated by other Biology faculty, which could explain some of the poor outcomes observed in the assessment. Third, the artifacts were only assessed by one assessor (Dr. Ana Almeida), and no inter-rater assessment validation was performed. Lastly, the assessor was also the instructor of the course, which might also interfere with the assessment scores. Anecdotal evidence from Dr. Almeida's experience within the ILO Subcommittee suggests that assessors tend to be stricter when assessing artifacts from their filed of expertise. It is possible in this case that at least part of the poor scores are due to assessor bias. Lastly, this assignment was given to students few weeks after the shelter-in-place came into effect. It is possible that student outcomes were greatly affected by the transition to online learning and other challenges related to this new pandemic reality.

Recommendations for Program Improvement: In order to close the loop, the Department should provide students the opportunity to further develop quantitative reasoning skills throughout their time at CSUEB. In particular, the department should create opportunities for students to better understand the scientific process in the context of the Biological Sciences, which would support the development of

applied quantitative reasoning and critical thinking skills. Lastly, the Department should review the current 5-year Assessment Plan in order to promote a more granular, and potentially more accurate, picture of student learning outcomes during their time at CSUEB.

Next Step(s) for Closing the Loop: The Department will discuss the creation of an undergraduate-level course on Philosophy of Biology/Foundations of Biological Research to support students in further understanding the logic behind the scientific process. During this course, the students will have the opportunity to develop quantitative reasoning as well as critical thinking skills in the context of research in the Biological Sciences. This course could be included as part of the BIOL140A/B discussion sections, rather than as an independent course. If the Department decides on the creation of an independent course, the Department will then discuss the appropriate location of the course within the current curriculum: whether it should be included as an entry-level course, such as a BIOL140C, or as a required course within the upper division, or as an elective course offered to all concentrations. In addition, the Department will develop BIOL602 (Preparation for Undergraduate Instruction in Biology) as a safe space for undergraduate students to learn from our graduate students. With guidance from the faculty-instructor, graduate students will develop curriculum on applied quantitative reasoning, specifically addressing challenges faced by our biology students. Graduate students will be available to mentor undergraduate students during the week, also addressing undergrad's specific course needs.

Other reflections: Although the ILO Quantitative Reasoning Rubric is an effective tool for assessing whether our students are meeting our program learning outcomes, a more refined assessment plan needs to be developed. A more granular assessment of student learning would not only help the Department understand when, along the curriculum, more effective changes could be made, but could also inform what student demographics might need more support or a different kind of support that is not yet being provided. Undoubtedly, the use of the same rubric over time will increase our statistical power, allowing the Department to better evaluate if any of our programmatic changes make a difference in student learning outcomes. However, the standardization of assignments for the purpose of assessment should go hand-in-hand with other efforts. We are confident that the development of BIOL602 as a safe space for undergraduate mentoring opportunities for our graduate students, in combination with an undergraduate-level Philosophy of Science/Foundations of Scientific Research course might bring us one step closer to closing the loop.

## II-B. SUMMARY OF ASSESSMENT – GRADUATE PROGRAM

### A. Program Learning Outcomes (PLO)

*Students graduating with a M.S. in Biological Sciences from Cal State East Bay will be able to:*

1. *Demonstrate a broad and sophisticated understanding that contributes to biological concepts and principles across all levels of biological organization, from ions to ecosystems (ILO 1,2,6);*
2. *demonstrate expertise in a specific area of biological science (ILO 6);*
3. *independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis (ILO 1,2,6);*
4. *clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation (ILO 1,2,6);*
5. *gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions (ILO 1,6).*

**B. Program Learning Outcome(s) Assessed**

Instrument: For the M.S. program we used the "Inquiry and Analysis Rubric" and the "Oral Communication Rubric" to assess the oral defense, a capstone event in partial fulfillment of the Master of Science Degree. A copy of these rubrics is included in the Appendix (Fig. A10). These rubrics are based on the VALUE rubrics developed by teams of faculty experts representing colleges and universities across the United States. The Value Rubric Development Project was sponsored by the Association of American Colleges and Universities.

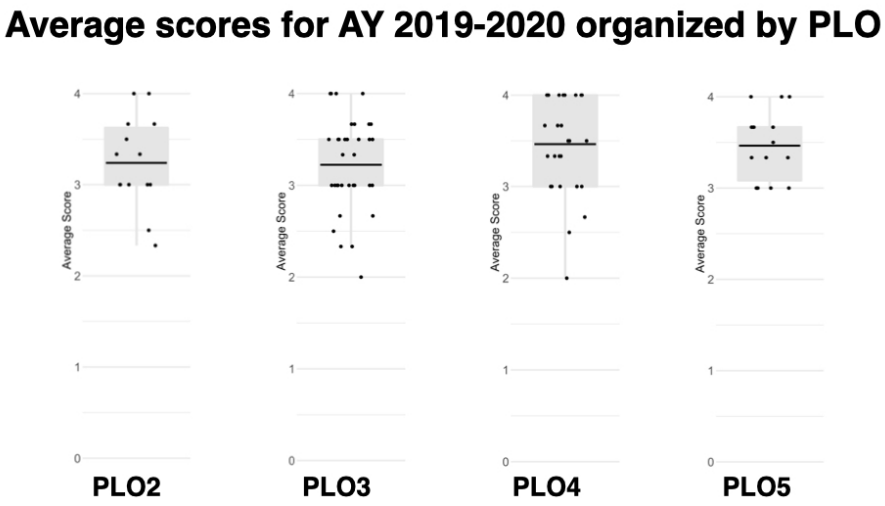
Sampling Procedure: The combined "Inquiry and Analysis" and "Oral Communication" rubric was applied to all 7 M.S. students that scheduled an oral defense in during AY 2019-20. The oral defense is one of the final requirements that our M.S. students complete. By the time a student schedules the oral defense, the University Thesis has been written and submitted for format review.

Data Collection: For the M.S. program, all three committee members (including the thesis advisor) were tasked to complete a combined "Inquiry and Analysis" and "Oral Communication" rubric just after the completion of the oral defense by the student. The thesis advisor would then collect the completed rubric forms and submit these documents to the Graduate Coordinator (Maria Gallegos). Upon receipt, the graduate coordinator would forward a completion memo to the University Graduate Evaluator. These strict procedures broke down somewhat this Spring 2020 due to the chaos of COVID-19. That said, most students were reviewed by three faculty members. Where that failed, two faculty members submitted an assessment. That said, one student was evaluated by only one faculty member and the data may not be as reliable (student code: one).

Data Analysis: For the M.S. program, the results shown in C (Summary of Assessment Results) include all individual data points (filled black circles). The black horizontal line represents the average. The gray boxes represent the first and third quartile and the vertical lines represent the minimum and maximum. Figures C1 through C3 below include data for all 7 students evaluated in AY 2019-20.

**C. Summary of Assessment Process**

Main Findings: For the M.S. program, we aim for all of our students to score at 3 (proficient) or above for all PLOs assessed. By looking at the data for individual PLOs assessed (Fig. C1), you can see that we met our goal. That said, same graph shows that some students are still scoring at 2 or near 2 (= basic) for PLOs 2, 3 and 4. In Fig. C2, the average earned score for individual assessment criteria is provided. This data demonstrates that on average, we again are meeting our goal of 3 or above. That said, you can see that the average score for criteria that belong in the inquiry and analysis category are lower than the criteria that belong in the oral communication category. Finally, when evaluating the performance of individual students (Fig. C3), two of the students (1 and 6) earned an average score below 3. In summary, while the data looks acceptable, we can still make improvements. See "Next Step(s) for Closing the Loop".




PLO2 through PLO5:

2. Demonstrate expertise in a specific area of biological science.
3. Independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis.
4. Clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation.
5. Gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions.

**Figure C1.** Average rubric score for each PLO evaluated. Please note that PLOs were evaluated by more than one criteria (see rubric in Appendix and list of individual criteria in Figure C2).

# Average scores for individual categories in the rubric

**Scores:**
**4 = Exemplary / Mastery,**
**3 = Proficient,**
**2 = Basic,**
**1 = Minimal.**

**Organization:** The introduction, approach, results and conclusions are sequenced skillfully. Overall, the content of the presentation is cohesive with seamless transitions.
**Language:** Uses language appropriate to the discipline as well as the audience. Discipline specific jargon is minimized or clearly defined.
**Delivery:** Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling. Speaker is polished and confident.
**Supporting Material:** Supporting material (illustrations, analogies etc) are relevant to the presentation and central message and establish the presenter's authority on the topic.
**Central Message:** Main claim is clear and compelling (precisely stated, appropriately repeated, memorable, and supported with evidence).
**Hypothesis/Question:** Develops a creative, manageable and testable hypothesis or question related to a topic that is significant yet poorly understood.
**Background Knowledge:** Synthesizes relevant information from reliable sources. Answers questions accurately.
**Design Process:** Develops methodology that is appropriate and clearly outlined. Includes proper controls.
**Analysis:** Performs an accurate analysis of the evidence to reveal the presence or absence of patterns related to the hypothesis/question.
**Conclusion:** States a conclusion that is a logical extrapolation from the evidence outlined.
**Caveats:** Insightfully discusses relevant and supported (if possible) caveats, limitations and implications.

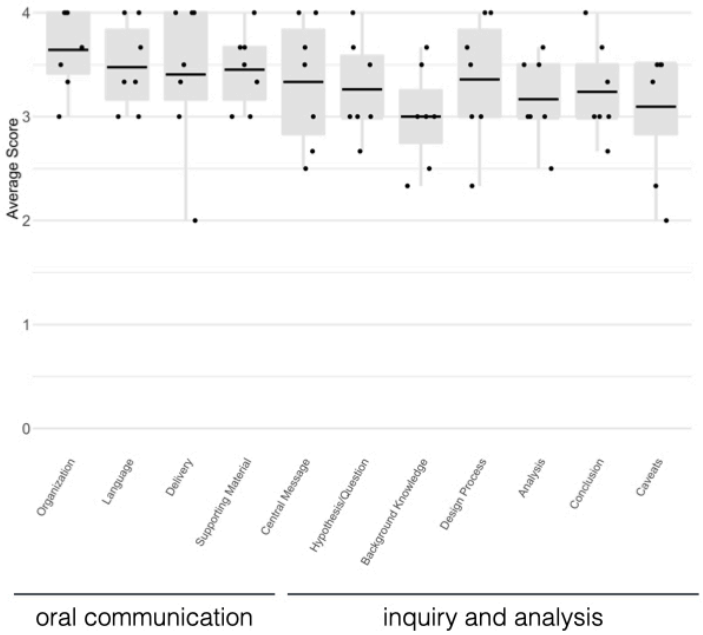



**Figure C2.** Average rubric score for each criteria outlined in the rubric. A list of categories listed in the rubric is found at right.

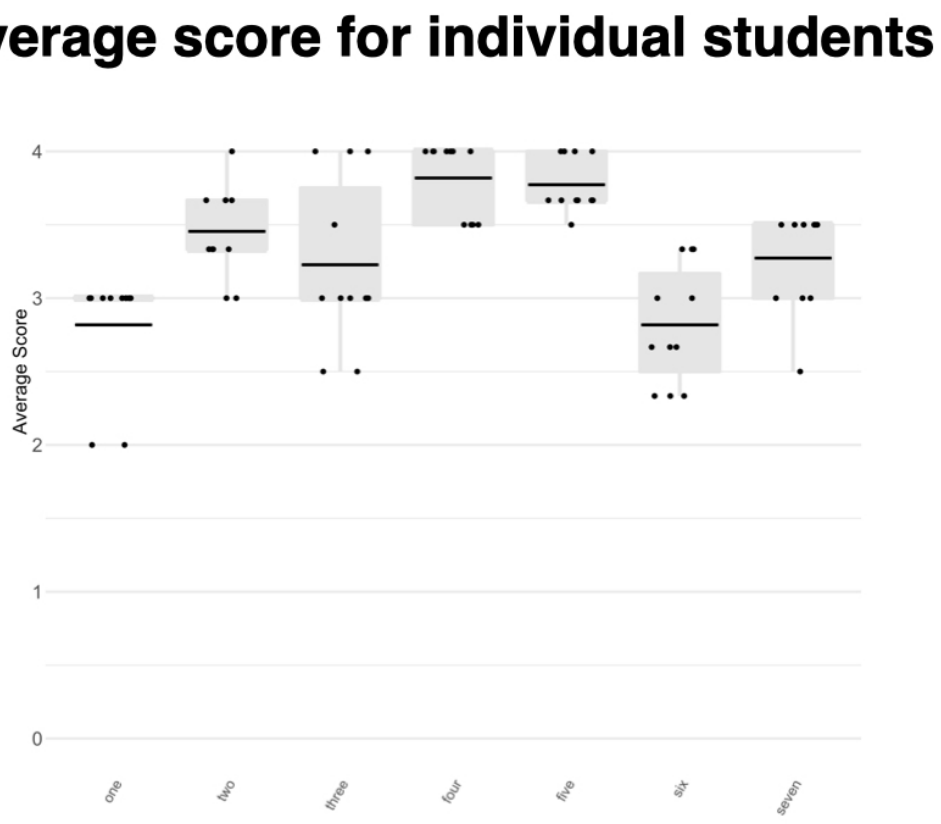



**Figure C3.** Average scores for each student. Students were numbered 1-7 from left to right.

**D. Summary of Assessment Results**

Recommendations for Program Improvement: We are aware of the areas in which our students require additional instruction and experience, and have decided upon steps that should be taken to improve student outcomes (see Next Step(s) below).

Next Step(s) for Closing the Loop: During our last program report review we had decided that our students needed a formative assessment prior to the oral defense so that we could identify students that are struggling with specific program learning outcomes. The idea was to address these issues before struggling students were too far along in their thesis studies. The faculty discussed the possibility of instituting a departmental requirement that students must meet with committee members on a per semester basis to demonstrate progress towards the completion their degree courses and thesis research. Unfortunately, implementation of this plan has been inconsistent at best. Moreover, COVID-19 derailed are nascent attempts to enforce these changes as we started to operate in emergency mode. This year we plan to redouble our efforts to implement this change as we still believe it would make an important difference to many MS students progressing through our program.

We also mentioned previously that our semester curriculum now includes a year-long foundations course (1 unit/semester) that is designed to explicitly teach our graduate students how to perform an effective literature review, communicate science (oral and written), gather and evaluate scientific data,

and identify assumptions, caveats and limitations of their proposed research. With two years of experience with these two courses behind us, we now realize that some important changes need to be made. The course description for 601A states, "*Foundations of Master's level skills needed to complete a research thesis. Application of the scientific method in the context of thesis formulation, experimental design, and accessing/evaluating scientific literature. Involves critical review of sample thesis proposals and drafting original thesis proposal.*" While the 601B course description states, "*Foundations of Master's level skills for effectively communicating scientific information. Application of the scientific method, in the context of communicating scientific findings and evidence-based conclusions. Emphasizes strategies in the presentation of scientific content and data to various audiences*." We decided that it is too premature to ask our first semester students to start working on a research proposal. The students need to gain more practical skills that will help them with that effort. Thus, we tentatively plan to reverse the order of these foundation courses and increase the proposal writing course to 2 units. Moreover, by making the second semester foundations course more about formulating a strong hypothesis and writing the proposal, we can use this as an opportunity to perform a formative assessment to see if and how our students are improving as the progress through the program.

Other Reflections: We are also confident that the modifications we are making to our year-long course in the curriculum that specifically focuses on the PLOs of the program will have a positive impact on the success of our M.S. students.

Assessment Plans for Next Year: In general, the faculty continue to value the rubric as an effective measure for assessing if our students are meeting our program learning outcomes. Thus, we plan to continue to use this same rubric to assess our MS students during the oral defense. By using the same rubric year after year, we will increase our statistical power and be able to evaluate if any of our programmatic changes make a difference in student outcomes. That said, we need to continue to have departmental discussions about what our expectations are for our MS students so that the data can be trusted from year to year. Also, we plan to begin to implement a formative assessment as students pass through the second semester foundations course. Then we can add longitudinal data to these reports as they become available.

## III. DISCUSSION OF PROGRAM DATA & RESOURCE REQUESTS

### A. Discussion of Trends & Reflections

Notable Trends: University Dashboard (APR) summary data for 2015 through 2019 is presented as tables and graphs in the appendix to this document. The student data presented includes Biology enrollment and FTES, degrees conferred, and breakdown of student population by gender, ethnicity and HUS status. Coursework data includes FTEF, FTES and SFR statistics. Please note that due to the small size of the graduate program (35 enrolled students), changes of a single student can result in large but non-significant shifts in enrollment and demographic measures. For this reason, trends in these data will only be highlighted if truly significant.

The following trends can be observed from the student demographics:

- Biology undergraduate enrollments increased marginally (+1.6%) in Fall 2019 after decreasing annually between 2015 – 2018 (Fig. A1).
- The graduate student population is currently listed at 35 in the APR summary, a 2.8% decrease from Fall 2018. However, as discussed in the self-study, these numbers only reflect students enrolled in courses and/or thesis units, and do not include approximately 25 additional active

students that have completed all degree units but have not yet completed the written thesis requirement (Fig. A1).

- The percentage of Latinx undergraduate students majoring in Biology has steadily increased since 2015 (currently 38%, Fig. A2).
- The percentage of Asian undergraduate students majoring in Biology has declined from 33% in 2015 to 25% in 2019 (Fig. A2).
- The percentage of Black/African American undergraduate students majoring in Biology has increased from 8% in 2015 to 10% in 2019 (Fig. A2).
- Undergraduate students majoring in Biology from historically underserved populations (HUS) has increased annually from 41% in 2015 to 48% in 2019 (Fig. A3).
- The ratio of undergraduate Biology majors identifying as male or female remains relatively consistent from year to year at 30%/70%, respectively (Fig. A4).
- Graduation rates increased significantly (especially in 2015-16 and 2017-18) with the push to graduate before the transition to semesters in Fall 2018, but fell to rates on par with previous years in 2018-19 (Fig. A5).
- Graduation rates for Black/African American Biology majors remains relatively consistent from year to year, while graduation rates for Latinx Biology majors increased by 5.7% in 2018-19 (Fig. A6).
- FTES dropped by 19.7% with the transition to semesters schedule in Fall 2018, but increased by 5.7% in Fall 2019 (Figs. A7 & A8)
- Aside from these minor changes, the student demographics have remained relatively constant over the 2015-2019 period.

The following trends can be observed from the faculty and coursework statistics:

- SFR for the department dropped from 30.2 in Fall 2017 to 25.4 in Fall 2018, but increased to 28.8 in Fall 2019. As of writing this the department SFR for Fall 2020 is at 29, exceeding the target of 27 recommended by Dean Singley (Figs. A7 & A8).
- The proportion of FTES taught by lecturers & TAs/tenure-track faculty has remained relatively stable from 2015 to 2019, fluctuating between 45%/55% to 37%/63%, respectively (Fig. A9).

<u>Reflections on Trends and Program Statistics</u>: The number of undergraduate biology majors appears to have reached its maximum in Fall 2015, gradually decreasing on an annual basis to Fall 2018 (a 9.8% decrease from Fall 2017), with the beginnings of an increasing enrollment trend in Fall 2019 (and Fall 2020). FTES values correspondingly decreased by 19.7% as expected with the drop in Biology major enrollment. These reductions were expected with transition to semesters as the department made a significant effort through advising to get as many students as possible graduated before Fall 2018. As we progressed into semesters, we fully expected our student numbers and FTES to increase to former levels as it became easier for students from other CSU campuses and junior colleges to transfer their earned semester units to CSUEB. This appears to be the trend based on Fall 2019 and Fall 2020 enrollment numbers. Given that roughly 39% of our current majors are transfer students, we expect that the move to semesters will continue to have a significant impact on student numbers and student-faculty ratios. The department of Biological Sciences previously had one of the highest SFRs within the College of Science, and was asked by Dean Singley to reduce this number to a value more in-line with those of other College of Science departments. This has been accomplished through the hiring of an additional tenure-track faculty and/or lecturers and TAs. Assuming our FTES continues to increase with growing interest in our Biology Education and Forensic Science concentrations, it will be necessary to hire additional tenure-track faculty in the near future.

Student demographics indicate that the department maintains a very diverse student body that is largely representative of the College of Science and University populations. We have observed a positive increase in the enrollment of HSU students, but it will be likely several years before these increases also reflected in our graduation rates for all HSU students. The department, college and university have launched several initiatives in 2020 that we are confident will continue to positively impact these students.

**B. Request for Resources**

The department is well aware of budget uncertainly going forward, and does not expect to be able to fill any of the following faculty or staff positions in the next academic year. However, these requests have been included here as we feel these are the program's greatest need going forward.

1. Request for Tenure-Track Hires

*Science Education Specialist* – As part of our transformed Biology curriculum, the department offers a B.A. in Biology Education. Enrollment in this concentration continues to increase on an annual basis as this is a field with growing demand around the country. Drs. Wildy and Inouye have been the driving force behind our Biology Education concentration, but with the move of Dr. Inouye into an administrative role and Dr. Wildy also assuming more administrative/service duties, the department is in need to of an education specialist to lead this growing concentration. The department requests the hiring of Science Education Specialist at the assistant professor level that will offer specific courses in the field and play a significant role in revitalizing the freshman year experience for Biology majors through improved course design and student assessment.

*Forensic Biologist* – The department offers a concentration in Forensic Science as part of our transformed semester curriculum. This is another field of growing demand in the United States, and student enrollment in the concentration at Cal State East Bay continues to increase. We request the hiring of a Forensic Scientist at the assistant professor level that could offer specific courses in the field, as well as teach general biology courses for majors and non-majors.

2. Request for Other Resources

As discussed in Part I above, Equipment Technician Brian Sowers (ET-II) retired in Fall 2019. The department initiated a replacement search to fill this position, but this was closed during the CSU-wide hiring chill in Spring 2020. There are no plans (or approval) to renew the search for this position during the current academic year. The Biological Sciences and Chemistry departments, as well as the College of Science, rely heavily on this position for maintenance, upkeep and repair of numerous pieces of equipment, and currently have no other option but to hire outside vendors when repairs or service are needed. The department requests that this vacant position be filled as soon as it is budgetarily feasible.

## IV. APPENDIX

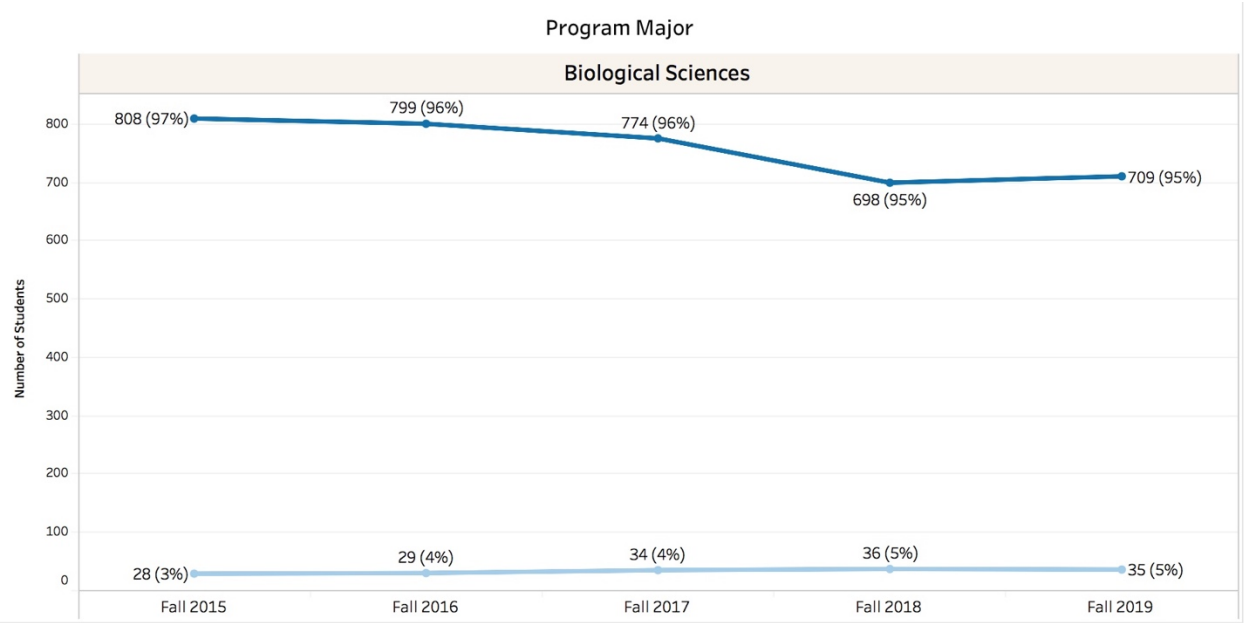



**Figure A1.** Dept. of Biological Sciences enrollment (Fall 2015 – Fall 2019).

Biological Sciences: Race/Ethnicity

| | | Fall 2015 | | Fall 2016 | | Fall 2017 | | Fall 2018 | | Fall 2019 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % | n | % |
| **Undergraduate** | American Indian | 2 | 0% | 2 | 0% | | | 1 | 0% | | |
| | Asian | 269 | 33% | 244 | 31% | 220 | 28% | 180 | 26% | 175 | 25% |
| | Black/African American | 65 | 8% | 64 | 8% | 65 | 8% | 64 | 9% | 71 | 10% |
| | Hawaiian/PI | 10 | 1% | 6 | 1% | 9 | 1% | 5 | 1% | 7 | 1% |
| | International | 30 | 4% | 33 | 4% | 39 | 5% | 39 | 6% | 34 | 5% |
| | Latinx | 262 | 32% | 278 | 35% | 272 | 35% | 258 | 37% | 272 | 38% |
| | Multiple Races | 36 | 4% | 38 | 5% | 46 | 6% | 37 | 5% | 32 | 5% |
| | Unknown | 28 | 3% | 29 | 4% | 26 | 3% | 32 | 5% | 28 | 4% |
| | White | 106 | 13% | 105 | 13% | 97 | 13% | 82 | 12% | 90 | 13% |
| | Total | **808** | **100%** | **799** | **100%** | **774** | **100%** | **698** | **100%** | **709** | **100%** |
| **Graduate** | Asian | 3 | 11% | 6 | 21% | 7 | 21% | 8 | 22% | 8 | 23% |
| | Black/African American | 3 | 11% | 4 | 14% | 3 | 9% | 2 | 6% | 1 | 3% |
| | International | 4 | 14% | 6 | 21% | 6 | 18% | 1 | 3% | 2 | 6% |
| | Latinx | 3 | 11% | 3 | 10% | 3 | 9% | 5 | 14% | 7 | 20% |
| | Multiple Races | 3 | 11% | | | | | 2 | 6% | 2 | 6% |
| | Unknown | 2 | 7% | 1 | 3% | 3 | 9% | 1 | 3% | 1 | 3% |
| | White | 10 | 36% | 9 | 31% | 12 | 35% | 17 | 47% | 14 | 40% |
| | Total | **28** | **100%** | **29** | **100%** | **34** | **100%** | **36** | **100%** | **35** | **100%** |
| **Grand Total** | | **836** | **100%** | **828** | **100%** | **808** | **100%** | **734** | **100%** | **744** | **100%** |

**Figure A2.** Biology students by race/ethnicity (Fall 2015 – Fall 2019).

| Biological Sciences: Historically Underserved (URM) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fall 2015 | | Fall 2016 | | Fall 2017 | | Fall 2018 | | Fall 2019 | |
| | | n | % | n | % | n | % | n | % | n | % |
| **Undergraduate** | | 30 | 4% | 33 | 4% | 39 | 5% | 39 | 6% | 34 | 5% |
| | HUS | 329 | 41% | 344 | 43% | 337 | 44% | 323 | 46% | 343 | 48% |
| | Non-HUS | 449 | 56% | 422 | 53% | 398 | 51% | 336 | 48% | 332 | 47% |
| | Total | **808** | **100%** | **799** | **100%** | **774** | **100%** | **698** | **100%** | **709** | **100%** |
| **Graduate** | | 4 | 14% | 6 | 21% | 6 | 18% | 1 | 3% | 2 | 6% |
| | HUS | 6 | 21% | 7 | 24% | 6 | 18% | 7 | 19% | 8 | 23% |
| | Non-HUS | 18 | 64% | 16 | 55% | 22 | 65% | 28 | 78% | 25 | 71% |
| | Total | **28** | **100%** | **29** | **100%** | **34** | **100%** | **36** | **100%** | **35** | **100%** |
| **Grand Total** | | **836** | **100%** | **828** | **100%** | **808** | **100%** | **734** | **100%** | **744** | **100%** |

**Figure A3.** Biology student enrollments by HUS vs. Non-HUS status (Fall 2015 – Fall 2019).

| Biological Sciences: Sex | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fall 2015 | | Fall 2016 | | Fall 2017 | | Fall 2018 | | Fall 2019 | |
| | | n | % | n | % | n | % | n | % | n | % |
| **Undergraduate** | Female | 558 | 69% | 543 | 68% | 537 | 69% | 478 | 68% | 493 | 70% |
| | Male | 250 | 31% | 256 | 32% | 237 | 31% | 220 | 32% | 215 | 30% |
| | Nonbinary | | | | | | | | | 1 | 0% |
| | Total | **808** | **100%** | **799** | **100%** | **774** | **100%** | **698** | **100%** | **709** | **100%** |
| **Graduate** | Female | 19 | 68% | 21 | 72% | 25 | 74% | 19 | 53% | 21 | 60% |
| | Male | 9 | 32% | 8 | 28% | 9 | 26% | 17 | 47% | 14 | 40% |
| | Total | **28** | **100%** | **29** | **100%** | **34** | **100%** | **36** | **100%** | **35** | **100%** |
| **Grand Total** | | **836** | **100%** | **828** | **100%** | **808** | **100%** | **734** | **100%** | **744** | **100%** |

**Figure A4.** Biology student enrollments by gender (Fall 2015 – Fall 2019).

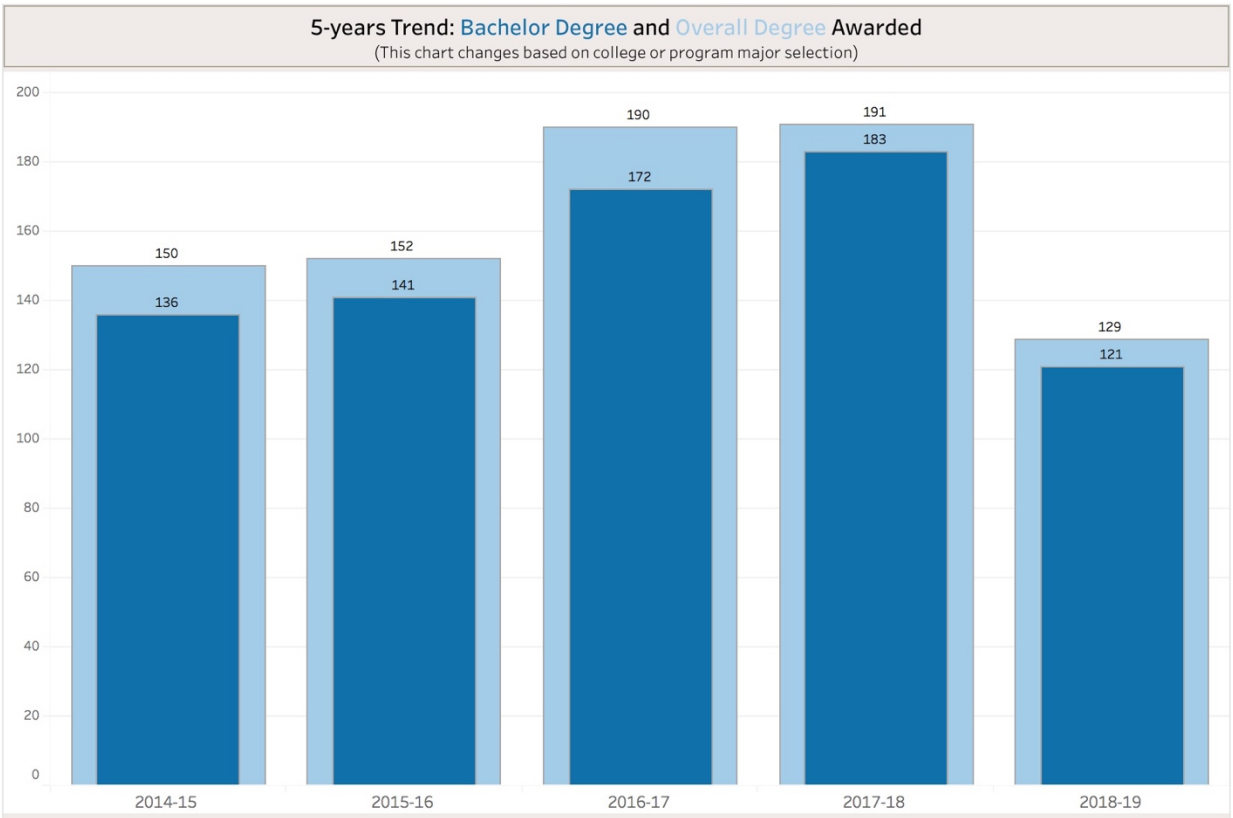



**Figure A5.** Biology degrees awarded 2014/15 – 2018/19 (dark blue represents undergraduate degrees conferred, light blue indicates undergraduate + graduate degrees conferred).

Historically Underserved Students

| | | Bachelor's | Master | Grand Total |
|---|---|---|---|---|
| HUS | Black | 6 | | 6 |
| | Latinx | 34 | 1 | 35 |
| | Total | 40 | 1 | 41 |
| Non-HUS | Asian | 41 | 1 | 42 |
| | Hawaiian/PI | 1 | | 1 |
| | White | 15 | 3 | 18 |
| | Multiple Race | 7 | | 7 |
| | Unknown | 9 | | 9 |
| | Total | 73 | 4 | 77 |
| International | International | 8 | 3 | 11 |
| | Total | 8 | 3 | 11 |
| Grand Total | | 121 | 8 | 129 |

**Figure A6.** Biology degrees awarded in 2018/19 by HUS, non-HUS and International status.

## APR Coursework Data: Summary: Fall Term as of Census

FTES, FTEF (instruction), and SFR of all state-side coursework

| | | Term & Year | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fall 2015 | | | Fall 2016 | | | Fall 2017 | | | Fall 2018 | | | Fall 2019 | | |
| College | Department | FTES | FTEF | SFR | FTES | FTEF | SFR | FTES | FTEF | SFR | FTES | FTEF | SFR | FTES | FTEF | SFR |
| CSCI | BIOL | 570.8 | 16.2 | 35.3 | 575.3 | 18.0 | 32.0 | 588.3 | 19.5 | 30.2 | 472.2 | 18.6 | 25.4 | 499.5 | 17.3 | 28.8 |
| | CHEM | 375.1 | 15.4 | 24.4 | 365.8 | 15.4 | 23.7 | 359.9 | 14.9 | 24.2 | 290.3 | 14.6 | 19.9 | 303.8 | 14.9 | 20.4 |
| | CS | | | | 388.6 | 15.0 | 25.8 | 394.8 | 13.4 | 29.4 | 361.5 | 13.6 | 26.6 | 426.9 | 14.5 | 29.4 |
| | EESC | 200.3 | 6.3 | 31.7 | 236.7 | 7.5 | 31.7 | 192.9 | 7.5 | 25.7 | 269.7 | 7.8 | 34.4 | 281.4 | 8.0 | 35.1 |
| | ENGR | 180.8 | 7.1 | 25.6 | 157.7 | 8.1 | 19.6 | 184.0 | 7.9 | 23.3 | 163.1 | 7.3 | 22.2 | 184.3 | 8.6 | 21.3 |
| | HSC | | | | | | | | | | 425.0 | 13.4 | 31.7 | 594.0 | 16.0 | 37.1 |
| | MATH | 960.7 | 36.6 | 26.2 | 673.4 | 25.1 | 26.8 | 629.6 | 23.2 | 27.1 | 449.0 | 17.0 | 26.5 | 461.3 | 17.0 | 27.2 |
| | NURS | 896.1 | 36.7 | 24.4 | 992.3 | 42.0 | 23.6 | 1,038.3 | 44.0 | 23.6 | 261.9 | 22.3 | 11.8 | 255.3 | 21.8 | 11.7 |
| | PHYS | 235.1 | 7.7 | 30.7 | 227.6 | 8.4 | 27.0 | 211.8 | 7.8 | 27.2 | 196.0 | 6.6 | 29.7 | 162.4 | 6.4 | 25.3 |
| | PSYC | 519.8 | 15.1 | 34.3 | 496.6 | 16.1 | 30.8 | 572.2 | 17.8 | 32.2 | 534.2 | 16.7 | 31.9 | 629.7 | 18.0 | 35.0 |
| | SCI | | | | | | | | | | 0.6 | 0.1 | 4.5 | 0.5 | 0.1 | 3.5 |
| | STAT | 351.8 | 9.2 | 38.1 | 378.8 | 10.4 | 36.3 | 366.9 | 10.0 | 36.6 | 352.0 | 10.9 | 32.3 | 379.1 | 11.8 | 32.1 |
| | Total | **4,290.4** | **150.3** | **28.6** | **4,492.7** | **166.1** | **27.1** | **4,538.7** | **166.0** | **27.3** | **3,775.7** | **148.9** | **25.4** | **4,178.1** | **154.6** | **27.0** |
| **Grand Total** | | **4,290.4** | **150.3** | **28.6** | **4,492.7** | **166.1** | **27.1** | **4,538.7** | **166.0** | **27.3** | **3,775.7** | **148.9** | **25.4** | **4,178.1** | **154.6** | **27.0** |

**Figure A7.** FTES, FTEF and SFR amounts for all departments of the College of Science (Fall 2015 – Fall 2019).

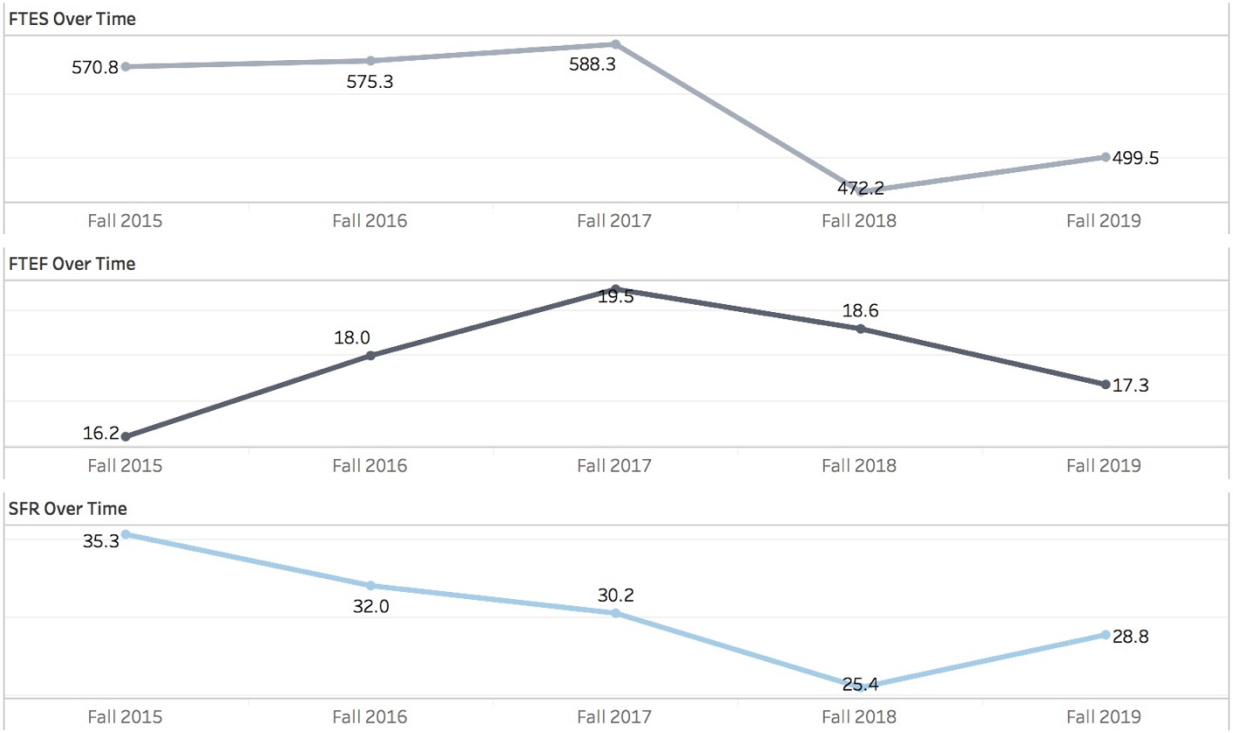



**Figure A8.** Dept. of Biological Sciences FTES, FTEF and SFR (Fall 2015 – Fall 2019).

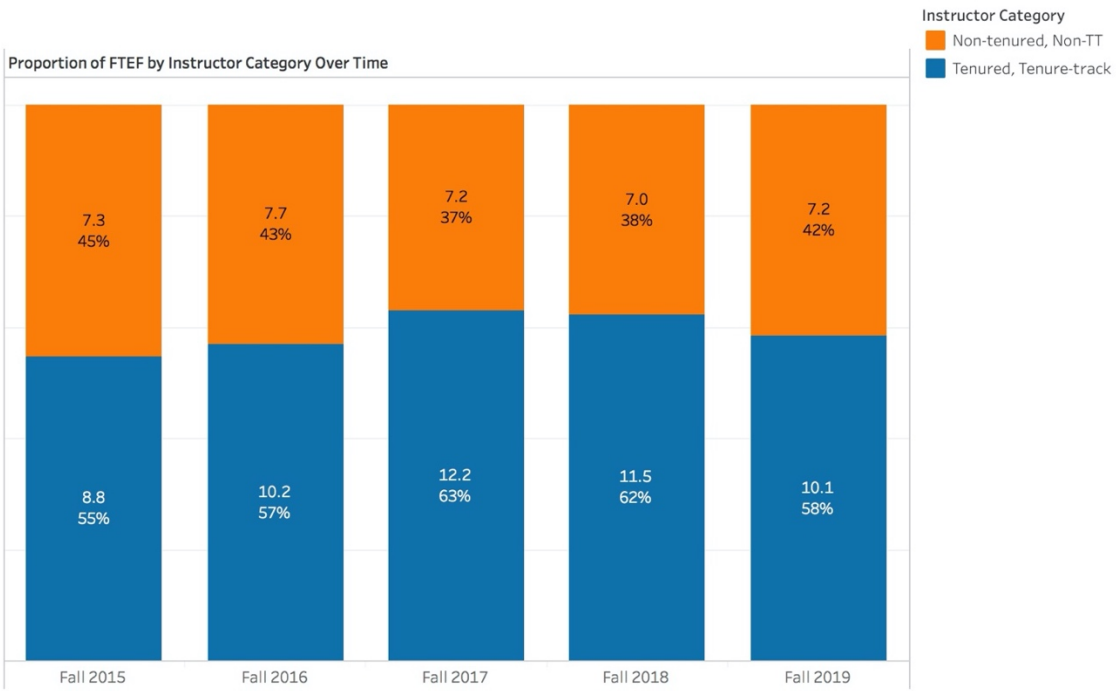



**Figure A9.** Dept. of Biological Sciences proportion of FTEF by instructor category (Fall 2015 – Fall 2019).

**Program Learning Outcomes:**

1. Demonstrate a broad and sophisticated understanding that contributes to biological concepts and principles across all levels of biological organization, from ions to ecosystems.
2. Demonstrate expertise in a specific area of biological science.
3. Independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis.
4. Clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation.
5. Gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions.

**A description of an exemplary score is provided for each criteria listed below.** An exemplary score is obtained for a given criteria when the description is true. A proficient score is obtained when the description is mostly true. A basic score is obtained when the description is somewhat true. ***Scores: 4 = Exemplary / Mastery, 3 = Proficient, 2 = Basic, 1 = Minimal.** *The rubrics below are modified from the VALUE RUBRICS.*

**ORAL COMMUNICATION RUBRIC (PLOs 2,4,5):**

| Criteria | Capstone / Mastery | SCORE* | PLO |
|---|---|---|---|
| Organization of the Presentation | The introduction, approach, results and conclusions are sequenced skillfully. Overall, the content of the presentation is cohesive with seamless transitions. | | 4 |
| Language | Uses language appropriate to the discipline as well as the audience. Discipline specific jargon is minimized or clearly defined. | | 2, 4, 5 |
| Delivery | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling. Speaker is polished and confident. | | 4 |
| Supporting Material | Supporting material (illustrations, analogies etc) are relevant to the presentation and central message and establish the presenter's authority on the topic. | | 5 |
| Central Claim(s) | Main claim is clear and compelling (precisely stated, appropriately repeated, memorable, and supported with evidence). | | 4 |

**INQUIRY AND ANALYSIS RUBRIC (PLO 3):**

| Criteria | Capstone / Mastery | SCORE* | PLO |
|---|---|---|---|
| Hypothesis/Question (not used for Thesis Defense) | Develops a creative, manageable and testable hypothesis or question related to a topic that is significant yet poorly understood. | | 3 |
| Background Knowledge | Synthesizes relevant information from reliable sources. Answers questions accurately. | | 2 |
| Experimental Design | Develops methodology that is appropriate and clearly outlined. Includes proper controls. | | 3 |
| Accurate Analysis | Performs an accurate analysis of the evidence to reveal the presence or absence of patterns related to the hypothesis/question. | | 3 |
| Logical Conclusions | States a conclusion that is a logical extrapolation from the evidence outlined. | | 3 |
| Recognizes Limitations and Implications | Insightfully discusses relevant and supported (if possible) caveats, limitations and implications. | | 3 |

**Figure A10.** Rubric used in assessment of M.S. student oral defense of thesis.