



**Fullerton College Program Review and Planning
Self-Study for Instructional Programs
Fall 2021**

Statement of collaboration

The program faculty members listed below collaborated in an open and forthright dialogue to prepare this Self Study. Statements included herein accurately reflect the conclusions and opinions by consensus of the program faculty involved in the comprehensive self-study.

Participants in the self-study

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Authorization

After the document is complete, it must be signed by the Principal Author, the Department Coordinator, and the Dean prior to submission to the Program Review and Planning Committee.

Spiros Dimitratos  2021-11-12

Printed name of principal author Signature Date

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Bridget Salzameda _____ Bridget Salzameda _____ December 14, 2021
Printed name of Dean Signature Date

1.0 Executive Summary (Please write this section last, but include it here at the front of the self-study, on a page all by itself.)

Please provide the reader with a brief overview of the highlights, themes, and key elements of this self-study. Please do not include new information you did not discuss earlier. Although you will likely write this section last, please remember to put this summary at the front of your report.

Mission

The Biology Programs support the College Mission, Vision, Values, and Goals in a variety of ways. Science programs promote critical thinking, inquiry and intellectual curiosity, which lead to life-long learning and personal growth. Our programs teach diversity on many levels of life, help students understand growth and change, and hold students to high levels of integrity and ethics. The programs support the college goals by working to increase student retention and success through tutoring, supplemental instruction, workshops, boot camps, seminars, field trips, and summer camps that both inspire and support student success. We reach out to the campus, district and general public with a variety of programs and events.

Students

Although we have seen an overall decline in enrollment over the past five years, due mainly to a decrease in students taking non-majors courses, our fill rates remain strong and enrollment losses have been partially mitigated by increases in biotech and biology majors classes during that same period. The student population in biology courses is broadly representative of the College, however, they are more likely to carry full-time course load.

Completion and success rates remain below College averages, but we achieved a 5% increase in student success since our last program review. This accomplishment is the result of an ongoing effort to improve our support for biology students. The vast majority of our majors transfer to universities upon completion of our programs. However, one area of concern for us is the low number that apply for and receive degrees and certificates upon transfer. A College or district-wide system to automatically track progress, audit transcripts, and award degrees and/or certificates to qualifying students would be a great improvement on our current system.

Outcomes

The Biology Department is in the process of redesigning our program-level SLOs. To date, we have adopted two new/modified PSLOs and are working on a third. We will continue to add and refine our PSLOs and assessments to better serve our students and the community at-large.

Course-level SLOs are assessed regularly and data show that 77% of our students meet the learning outcomes. Most ethnic groups are close to the average, however, African American students only meet

the outcomes about 63% of the time. Because of the low number of African American students taking biology classes, it is hard to determine whether this gap represents a real pattern or simply an anomaly due to low sample size. We will continue to monitor this development and work towards a solution if needed.

Program Effectiveness

Biology courses are an integral part of the College's General Education pathway. The majority of our students are taking biology courses to meet GE requirements. We strive to make our classes accessible to any student that needs to take one. Our courses are offered at a variety of time slots (morning to evening) from Monday thru Saturday. We are also offering an increasing number of dual enrollment courses for high school students.

In addition to making our classes accessible, we implement a wide variety of active learning and high-impact practices. These include flipped classrooms, classroom polling, service learning, research, field trips, boot camps, summer camps, and more.

Planning

Since our last program review we have made significant progress on our previous SAPs, including updating and adding degree and certificate programs, providing research and internship opportunities to students, and mentoring services to biology majors. We have 10 new and/or ongoing SAPs in this current program review, as follows:

- SAP 1: Create a STEM Resource Center
- SAP 2: New Full-Time Dual Enrollment Instructor
- SAP 3: New Full-time Biology Instructor (Organismal Biology)
- SAP 4: Collaboration with Administration of Justice Department
- SAP 5: Offer Biotechnology courses as short-term classes
- SAP 6: Update High Use Biology Prep Room/Lab Room Equipment
- SAP 7: Update Classroom Technology for Student Assessment and Collaboration
- SAP 8: Replace Models and Expand Specimen Collections and Manipulatives for Biology Courses
- SAP 9: Funding for Research Projects
- SAP 10: Host Regional Biotechnology Credentialing Assessments

All of our SAPs will have a positive impact on student success and several of them are strongly tied to equity issues. Beyond our SAPs, our long-term goals include expanding our limited space to better meet the needs of students and increasing our collaborative relationships with other departments.

2.0 Mission

Mission: The Department of Biology is an integral component of the mission of Fullerton College. Students in our program learn to think critically and to analyze the world around them using the scientific method. Our program promotes inquiry and intellectual curiosity. These principles give students the skills necessary to excel in their career and educational goals. Our degrees and certificates provide a solid foundation for students to continue their educational journey at a transfer institution or to enter the workforce.

Vision: We live in an era of unprecedented technological and scientific advances. Our programs transform the lives of science and non-science majors by helping them understand and appreciate the significance of modern discoveries. Our curriculum and faculty inspire students to participate in the future of biology, biotechnology, medicine, ecology, and many other related fields.

Core Values: The Biology program at Fullerton College has a long tradition of excellence. This program has provided the academic foundation from which countless numbers of students have progressed to advanced degrees in biology, medicine, allied health, and other sciences for over a century. Moreover, thousands of general education students have used our courses to broaden their understanding of the natural world and enhance their programs of study.

The core values of Fullerton College are well-supported by the Department of Biology. Our curriculum contributes to students respecting and valuing diversity by teaching them the biological mechanisms that create diversity in nature and humans. We are continually updating our curriculum and course topics to include new discoveries and innovative techniques. Science is never static, and as scientists we must continue to grow and learn in our fields of study or we will be left behind. Likewise, we hold our students to high standards of academic growth and expect them to adhere to the demanding standards of integrity and ethics that are required of a scientist. Finally, we strive to better our world by improving the scientific literacy of its citizens and by promoting the healthful well-being of our community.

College Goals: Our department is working hard to promote student success and reduce the achievement gap. Since our previous program review (2017), we have striven to increase retention and success among male, female, Hispanic, African-American, and non-traditional students. Every semester we provide tutors for both majors and non-majors courses. These tutors are selected from the science student population and have previously demonstrated excellence in the topics they tutor. Some of our tutors are paid through grants awarded to the college and/or individual faculty members. However, some of our student tutors volunteer so that they can gain more experience with a subject and remain current in their fields of study. Additionally, many of our courses have weekly supplemental instruction sessions to assist students and promote their success.

We are constantly interacting with our Fullerton College, Orange County, and scientific communities. Every year we offer multiple seminars to engage the students, faculty, administration and the general public. We host workshops, preparatory “boot camps,” and STEM field trips to educate and inspire new students, prospective students, or anyone interested in additional experiences in the sciences. Every year, we run a series of Science Summer Camps and outreach events for the region. Additionally, we maintain our interaction with our colleagues in the scientific community through research publications, invited presentations, and training workshops.

3.0 Students

3.1 Enrollment demographics

1. *Using the data provided by the OIE, briefly describe the enrollment trends in the program over the past five years.*

Over the past five years, the Biology department has experienced a 14.9% decline in enrollments and a 16% decline in head count, compared to the college average of 11.8% decline for both. Much of this decline happened in 2019/2020, partly due to our inability to offer certain courses via remote instruction. These courses included two summer sections of BIOL 170 (Organismal Biology) in 2020 and 2021, a section of BIOL 193 (Biotechnology C: Molecular Biology) in Spring 2020, a section of BIOL 196 (Tissue Culture Methods) in Fall 2020, and a section of BIOL 104 (Insects and Spiders) in Fall 2020. We have also been unable to offer BIOL 141 (Marine Mammal Biology and Conservation) and BIOL 222 (Marine Biology) since AY 18/19 due to a faculty retirement.

A closer look at the enrollments by course shows that while we have seen declines in our largest non-majors courses, there has been a steady increase in enrollments in our biology majors courses over the last five years, and in our biotechnology certificate courses over the four years before AY 20/21. One exception to the non-majors decline has been in BIOL 100 (Principles of Biology), a 4-unit course that is very similar to the 5-unit BIOL 101 but does not include a lab.

Our four majors biology core courses, BIOL 170, 272, 274, and 276 have all shown an increase in enrollment, ranging from a 17% increase in BIOL 170 enrollments from AY 16/17 to AY 19/20, to a 52% increase in BIOL 274 enrollments over five years. This, together with the full waitlists that are typical of all our BIOL 170 sections, would suggest that there is potential for growth that could be met if we hire a new full-time faculty member to teach BIOL 170 and BIOL 222 (Marine Biology). There has also been tremendous growth in BIOL 190 (Introduction to Biotechnology), the first course for the biotechnology certificate series, partly due to the increased demand for dual-enrollment sections from the high schools in our area. We see dual-enrollment courses as another area for potential growth, by increasing our biotechnology offerings and, perhaps, offering BIOL 102 (Human Biology) as a dual-enrollment course.

2. *Using the data provided by the OIE, describe the student population the department serves. Do you have a way of determining which students are majors, for example through a gateway course? Please explain.*

Biology majors are readily identified on the basis of their enrollment in BIOL 170, the Organismal Biology course in which all majors must enroll. BIOL 170 is a prerequisite for the advanced courses in the BIOL 27x series (BIOL 272, BIOL 274, BIOL 276) and thus serves as a *de facto* “gateway” course for our majors.

The Biology Department serves a diverse population that mirrors that of Fullerton College and the surrounding community. The majority of our students pursue a degree and/or transfer to a 4-year institution. Our data indicate 78% of our students are seeking an AA/AST or intend to transfer and pursue a bachelor of science degree; this finding is in accord with the general rate of interest in a degree or transfer for Fullerton College (77%).

A smaller segment of our students (1%) enroll only for a certificate. Since our last program review, we have noted an increase in the number of students who have already earned a bachelor of science degree and are returning to gain more hands-on technical skills. Currently, 5% of our students enroll in career development courses and then pursue employment directly. These students frequently have already completed a four-year program; some have also completed masters-level programs. Reasons provided by post-baccalaureate students who enroll in our classes include the need for more training encouraged by their employers, interest in changing positions or advancing within their fields, and interest in pursuing advanced degrees that require laboratory skills they were unable to obtain at a university.

Our department serves students from low-income backgrounds, with 77% of our students being low-income compared to 74% for Fullerton College as a whole. Although we do serve recent high school graduates (in fact, we serve high school students directly through our dual enrollment classes), we note that 52% of our students are 20 to 24 years old. There are several potential reasons for the age distribution of our students, including the demands of our curriculum which includes courses in mathematics, physics, and chemistry in addition to biology. Our students are also more likely to be enrolled full-time than the average FC student; although only 22% of the general student population at Fullerton College enrolls in over 24 units per year, 49% of our students do so.

Demographic data from our student population reveal that, similar to the Fullerton College average, 57% of our students are Latinx. However, our department serves more Asian students and fewer White students than the college average. Moreover we note a gap in gender; only 38% of enrolled students are male, and among students who are majoring in biology the gap is wider, with only 36% of biology majors identifying as male.

- 3. Which classes have the highest demand and why? Are they offered regularly -- at different times of the day and week, in different formats (in-person, on-line, hybrid)? Please explain.*

AY 20/21 data (Appendix A Section 3.1.1) indicate BIOL 101, General Biology, accounts for approximately 43% of the enrollments in our program. This is a 5-unit combined lecture and lab non-majors course which fulfills a GE requirement for a life science with a lab. Approximately 25% of our majors students first take BIOL 101 to ensure a strong foundation for the rigorous biology majors core. While enrollments have declined over the past five years, BIOL 101 remains a very popular course, and we ensure access by offering it at various times during the day, in the evening, and in a high-demand

Friday evening lecture and Saturday lab combination. We offer BIOL 101 classes in-person only because of the three-hour lab component that is built into the class.

BIOL 102, Human Biology, has the second-highest enrollment in our program, with 19% of the total enrollments. Because the lab component of the course is optional and offered separately, we have been able to offer an online section of BIOL 102 every semester, including summers. However, we should note that total enrollments in this course have fallen by 38% in the past five years, for reasons that should be explored. As enrollments fell we decreased the number of sections we offered, and due to full-time faculty scheduling conflicts we have offered the majority of those sections on Mondays and Wednesdays. We intend to offer more sections of BIOL 102 on Tuesdays and Thursdays beginning in Fall 2022.

BIOL 170 (Organismal Biology) is our third highest-enrollment course, with approximately 10% of total enrollments. This is the first course of our biology majors core, effectively serving as the gateway course for majors. Enrollment in Biology 170 increased over the four years before AY 19/20, and we expanded the number of sections as much as space and staffing allowed. We offer BIOL 170 five days a week during the Fall and Spring, including two evening sections on Monday/Wednesday and Tuesday/Thursday. Before the pandemic we also offered a section of BIOL 170 every summer, and we intend to reinstate our summer section in 2022. All our majors courses are offered in-person only due to the lab component and the rigorous nature of the courses. We also have a policy of staffing these classes with full-time faculty with a specialty in that specific area. If we are able to hire an additional full-time faculty member, we will be able to offer more sections of this high-demand course.

BIOL 102L (Human Biology Laboratory), our fourth-highest enrollment course, cannot be offered online. We typically offer this class in the afternoons (Monday through Thursday) with an additional evening section most semesters. This scheduling maximizes scheduling efficiency for students who take the BIOL 102 lecture earlier in the day.

Finally, BIOL 272 (Cell and Molecular Biology), our fifth-highest enrollment course, has also had increased enrollment over the last five years, with three sections each semester, one of which is offered in the evenings. Again, as a majors course with a lab component, we do not offer an online version of the class.

In summary, our highest-enrollment courses are offered at various times and days of the week, with most of those classes being offered in person. Our online offerings include BIOL 102 (Human Biology), BIOL 100 (Principles of Biology), and BIOL 109 (Genetics and Biotechnology in Society), all of which are non-majors courses without a lab.

4. *Please describe how course offerings match students' preparation and goals.*

Our curriculum is designed, and our course offerings are scheduled, to maximize the opportunities for students to make progress towards a degree, transfer, and/or employment in their chosen discipline. Our degree/certificate maps are thus targeted toward higher academic/institutional success rates.

Biology majors core courses are articulated for biology transfers to all state universities (CSU and UC), and BIOL 109, 170, and 272 serve as the prerequisites for students preparing for health professional schools (medical, dental, vet, physical therapy, physician assistant, etc). Since our last program review, we have added transfer agreements with MiraCosta College and Solano College that allow our certified biotechnology graduates to transfer into their baccalaureate-level Biotechnology degree programs.

Those students who are interested in entering or reentering the workforce directly from Fullerton College are also served with our biotechnology courses and certificate programs, as our faculty's up-to-date understanding of the industry needs provides the necessary technical training and job readiness guidance.

There are several areas where we are expanding our preparation of students for careers in the biosciences. We have increased our dual-enrollment biotechnology course offerings at local area high schools, which helps students, parents, teachers, counselors, and administrators see the opportunities available in biology and serves to recruit students to our department as early as possible. See **SAP #2**.

Additionally, our BIOL 297 Biosciences Internship course (initially offered in Fall 2021) will further our students' exposure and practice in research skills, healthcare, and the biotech industry. These experiences will enrich our students' academic careers, assist in career exploration, prepare job-readiness skills and help close any equity gaps.

Thus, our strategy for matching course offerings to students' preparation and goals has been to maintain a clear pathway from enrollment to achievement, recruit students into the pathway early, and illuminate the possible outcomes so that students are better informed in choosing coursework initially and potential careers ultimately. By engaging students as early as possible, either from secondary schools via our dual enrollment classes and community outreach activities or from our own Fullerton College freshman classes via our open houses and "Meet the FC Biology Faculty" events, our department takes a direct role in student matriculation. Once recruited, students are then offered resources (such as boot camps, tutoring, mentoring, and networking) to be better prepared and increase their opportunities to succeed.

5. *Does enrollment vary by semester? Please describe how course offerings are adjusted to meet student demand and help students reach their academic goals.*

Enrollments in our highest-enrolling courses are consistent from semester to semester, and we offer these classes, and all majors classes, in both Fall and Spring. In addition, BIOL 101, 100, 102, 170, 190 and 190L are typically offered during the summer. Seven years ago we increased our sections of BIOL 101 by over 60% to meet student demand, and recent reductions were due to declining enrollments. We were also able to increase enrollments in BIOL 170 (Organismal Biology) five years ago with the hiring of two new full-time faculty members (one was a retirement replacement). There is still unmet demand for BIOL 170, which is why we are requesting a new full-time faculty member to teach the class. See **SAP #3**.

Our beginning biotechnology classes (BIOL 190, 190L and 191) are required for the Level I Biotech Lab Assistant certificate, so we offer these classes every semester in order to meet demand. These courses are offered at various times during afternoons and evenings to accommodate adult workers, returning and non-traditional students. The higher-level biotechnology classes, which are required for the Level II and Level III biotech certificates, are offered in either Fall or Spring terms. We plan to offer the advanced courses for 8 weeks, to better serve students who want an overall shorter training period (such as post-bacc and incumbent workers). See **SAP #5**.

3.2 Student Achievement and Equity

1. *Using the data provided by the OIE, briefly describe student achievement rates in your program over the past five years: completion, success, degrees/certificates, transfer, licensing, job placement, wage improvements (not all of these measures apply to every program).*

During the past five years, course completion rates have remained steady at approximately 77%. This figure is marginally lower than the campus average of 82%. Completion rates are consistent for our program and comparable to the data from other departments in Natural Sciences. Course success rates average approximately 62% over the last five years. Success rates are lower than the campus average of 69%, and slightly lower than most other departments in Natural Sciences. From 2018 to 2021, course success has been steadily increasing, by a total of 5%.

The number of degrees and certificates awarded by our program is highly variable by year. A large majority of program awards are associates degrees, mainly the AA in Biology. The Biology AA degree was recently updated to better match transfer requirements, which vary by transfer institution. This update has improved the flexibility of the AA degree for biology majors students planning on transferring to specific universities. In addition, the Biology AS degree is currently in the final step of a curriculum update to better align the degree program with core biology majors classes, which should increase the number of students eligible to earn a Biology AS. The AS-T in Biology was recently approved by the state, and both two-year and three-year AS-T plans have been mapped with the Guided Pathways committee. Based on our recent updates, awards of all three degrees should continue to increase in the future.

Approximately 25% of program awards since 2018 have been certificates in the Biotechnology program. We also have several new certificates in Biotechnology that were recently approved by the state. These include the Level I Biotechnology Laboratory Assistant, Level II Biomanufacturing Technician, and Level III Biotechnology Laboratory Technician certificates. Specific Biotechnology classes could not be taught remotely, but routine availability will resume in 2022 as CDC guidelines permit, which should also contribute to increasing the number of awards in the future.

The number of awards earned by biology students is consistently significantly lower than the number who could potentially receive awards, largely due to the lack of a standardized system for identifying degree and certificate qualification. This gap is demonstrated by data from 2018-2019, where we saw a large increase in awards earned. This increase was the result of individual biology faculty members tracking course completion by students, and directly assisting qualified students in filing for awards. A system is needed to automatically award qualifying students degrees and certificates based on successful course completion. Identification of students who could earn awards would be improved by the proposed STEM Center (see **SAP #1**).

The Biology Department produces a large number of students who transfer to further higher education. Our enrollment in terminal majors classes (BIOL 274/276) is approximately 130 students a year. The number of transferring students ranges from 110 to 175 students per year. This suggests that the majority of biology majors students are successfully transferring to a four-year institution. A large proportion of transfer students (approximately 80%) simply major in biology, rather than officially earning a degree or certificate. Since transfer students plan to eventually earn a higher degree, they are less likely to apply for awards at Fullerton College, and may not even know that they could receive awards. However, most of these students would be eligible for at least one degree or certificate, further supporting the need for an automated system to award degrees.

Transfer rates to four-year colleges have increased in the last three years. The majority of transferring students (64%) attend CSUs and UCs, with the most common transfer institution being CSU Fullerton by a large margin. The high rate of transfer to local institutions emphasizes the importance of maintaining connections between the Fullerton College Biology Department and nearby universities. Our department strongly emphasizes programs such as Project RAISE and UCI Bridges that help our students strengthen their applications for transfer and develop early relationships with these high-volume transfer institutions.

The life sciences sector includes diverse industries that are increasingly enjoying increased public visibility and sustained demand. California currently has the strongest biotechnology employment base with more than 235,000 jobs pre-pandemic and has sustained high demand during the public health crisis. By 2019, Los Angeles County and Orange County housed over 4,000 biotechnology firms employing roughly 128,700 people. Industry-leading firms headquartered in our county include Allergan,

Abbott, Edwards Biosciences, Beckman Coulter, and others. Furthermore, there are multiple public and private universities within a 25 mile radius of Fullerton College that employ our graduates.

If we consider only technician-level jobs in allied fields, the labor market demand data for the Los Angeles and Orange County Region shown below estimates 4,218 job openings annually across the biotechnology industry while the supply of students trained in Biotechnology and Biomedical Technology in the LA/OC regions was an average of 170 awards between 2017-2020 according to the Orange County Center of Excellence Biotechnology Report, August 2021. This report notes a supply gap for trained candidates. The demand in our area is significant, and we hope to increase the number of students completing certificates in biotechnology and/or AA/AS degrees in biology/biotechnology to meet the high demand for our region. The following data from the report depict extant and predicted occupational demand for technicians and specialists from our field.

Table 1a. Employment data and predictions from the COE Biotechnology Report, August 2021 for Los Angeles and Orange Counties.

Geography	2019 Jobs	2024 Jobs	2019-2024 Change	2019-2024 % Change	Annual Openings
Los Angeles	31,012	28,960	(2,052)	(7%)	2,868
Orange	13,526	13,259	(267)	(2%)	1,350
Total	44,538	42,220	(2,318)	(5%)	4,218

Table 1b. Selected job openings, wage data and predictions from the COE Biotechnology Report, August 2021. These data concern Orange County.

Occupation (SOC)	2019 Jobs	2024 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Biological Technicians (19-4021)	582	622	40	7%	68	\$17.79	\$22.54	\$28.57
Life, Physical, and Social Science Technicians, All Other (19-4099)	1,059	1,160	102	10%	142	\$19.00	\$25.73	\$33.55
Clinical Laboratory Technologists and Technicians (29-2018)	3,107	3,426	320	10%	245	\$21.67	\$29.33	\$43.45
Inspectors, Testers, Sorters, Samplers, and Weighers (51-9061)	8,089	7,327	(762)	(9%)	827	\$15.47	\$19.67	\$27.11

The post-pandemic job market for biologists and allied scientists is difficult to assess, but certain industry trends are emerging. The skills and training of our graduates translate into several industries,

including but not limited to environmental scientists and technicians, biopharmaceuticals, diagnostics development and manufacturing, and agricultural biotechnology. In the Recovery Jobs by Economy report by Burning Glass (Feb 2021), biotechnology is expected to generate a total of 115,920 jobs, environmental science will generate 516,656 jobs, and the pharmaceutical industry another 583,603 jobs in the post-pandemic era.

Regarding job placement for our graduates, our efforts are multi-faceted. In response to District Strategic Direction 2: *The District will annually make progress toward eliminating the documented achievement gap among race/ethnicity groups*, we have gained approval from the NOCCCD Board of Trustees to become a member of BioMADE, a partnership established under the aegis of the National Network for Manufacturing Innovation and supported by agencies including the Department of Defense, the Department of Energy, the National Science Foundation and the National Institute of Standards and Technology. The initiative will enhance domestic bio-manufacturing capabilities and our membership will allow our students to access competitive positions in academic and/or industrial laboratories.

We have also obtained federal and state funding to support community/industry outreach and job placement efforts. We will continue to make our students aware of the opportunities for employment and/or education, provide them with competitive skill sets, and make local industrial and academic research institutions aware of the competency and promise of our students. Since 2017, 56 FC biology students have participated in 83 bioscience internships.

2. *Please pay special attention to equity issues -- where a group of students has an achievement rate that is below average. What factors can explain this?*

There are equity gaps evident in the Equity Analysis, based mainly on race and income level. Equity gaps persist for Black and Latinx students. Course success rates are higher than average for Asian students, but lower for Black and Latinx students. Students in the equity gap represent 7.7% of all Black students, and 12% of all Latinx students. The same pattern appears in transfer rates. Asian students represent 13% of enrollment, but 30% of transfers. Black, Latinx, and White students all show lower proportions of transfers relative to enrollment. The largest equity gap with regards to transfer is in Latinx students, who represent 57% of enrollment but only 38% of transfers. These differences also appear in program awards, but to a lesser degree. In addition to race, low income status also has a strong negative impact on course completion and success. Similar patterns are evident in the data from other departments in the Natural Sciences division.

Factors that may contribute to this equity gap could include the socioeconomic disadvantages faced by students in low income brackets. Low income students may carry a larger burden of family commitments as well as work hours, leaving less time for them to dedicate to school. Many of our courses are high-unit due to lab components, and hence require a substantial number of both in-class and out-of class hours each week. Finding enough time to allocate to schoolwork may be a greater challenge for lower income students. Although we have increased our flexibility and our use of currently

recommended equitable grading practices (see Section 3.2.3) in an effort to ease this issue, there are likely many remaining equity issues outside the direct control of the department. Biology faculty are invested in evaluating our own classroom practices and are making a concerted effort to work towards more equitable instruction. Data from the college's Summer Inquiry Group on campus climate suggest that students of color feel less comfortable on campus and are more likely to perceive that they do not matter. We continue to collaborate with campus experts in these issues to better understand the causes of the equity gap, and address them in appropriate ways.

There are no substantial equity gaps present with regards to gender, foster youth, or LGBT identification. DSS students show lower completion and success rates than non-DSS students, but the gap is not as significant as the racial or income-related equity gaps. Students with military status have higher completion and success rates. One possible factor contributing to the impact of DSS and military status may be differences in organizational and time management skills which are critical to success in higher-unit biology classes. Also, we have found anecdotally in talking to our students that many may not be aware of how to obtain official DSS accommodations, or may not request accommodations even if they qualify for them. This is supported by the results of the Summer Inquiry Group on campus climate, which suggest that large segments of the student body are unaware of campus services offered and/or do not access them.

- 3. Does the department have regular discussions about equitable grading, attendance, late-work, and extra credit policies, or about other strategies for helping students succeed? Could reforming classroom policies help more students succeed? Please explain.*

The department discusses course policies, grading, and student success rates on a regular basis. All department faculty use policies and grading practices designed to help students achieve success. The Biology Department designed and participated in multiple flex day activities in 2020-2021 focused on equitable grading practices, and the results of implementing these practices in our classes. Commonly used practices include dropping assignments, accepting late work, giving multiple attempts on assignments, and open book quizzes/exams. Moreover, we have increased our flexibility in offering make-up exams and assignments to students with scheduling, family, or health-related conflicts. The department has also made an explicit effort to make it clear to all students that these options are available to them, rather than only offering exceptions to students who ask. Although we require attendance in all our classes, biology faculty frequently extend accommodations to students who may experience personal difficulties that interfere with attending or completing assignments.

Because the Biology Department has increased the usage of equitable grading policies in recent years, we do not yet know to what degree these practices have affected student success or whether there has been an impact on equity gaps. In the last year we have observed a modest increase in success rates. Although the online instruction environment presents challenges in terms of monitoring academic honesty, it also affords us increased flexibility in course scheduling and assignment due dates. We offer

several courses early in the morning, late at night, or on weekends to accommodate students who have professional or domestic responsibilities and cannot attend a more “conventional” M-F 9-5 schedule.

- 4. Please write a brief Equity Action Plan. What strategies can you implement to close this gap in student achievement within the next five years? What professional learning, curriculum development, or other forms of support does your department need?*

A key component of our Equity Action Plan is the creation of a dedicated STEM center and STEM director on campus (see **SAP #1**). Science majors are challenging yet offer many career opportunities; we want to help guide students to reach successful outcomes, including transfer and workforce placement. A STEM center would provide an inclusive, supportive environment for STEM students to interact with faculty, counseling, tutoring, and other STEM students.

The STEM center would facilitate opportunities for our department to work more closely with STEM counseling, including regular discussions between science faculty and counseling to discuss and address the issues our students may be facing. Improved student-focused advising through the STEM center could make a big difference in the success of every student. For example, students with greater external burdens (such as low income students) need more guidance on a case-by-case basis in building a course schedule that gives them better chances to be successful while managing their nonacademic responsibilities. In addition, we plan to continue our efforts to provide faculty mentoring to students to help build their preparation for their specific educational and career goals.

Another main goal of the proposed STEM center is to create a student-centered environment to increase connectivity to the college and foster feelings of participating in a community of scientists. Our aim is to provide an increased sense of belonging for all students, helping each student feel that they matter to the faculty, to each other, and to the college as a whole. This sense of belonging may help reduce race-based achievement gaps. In order to meet this goal, the STEM center will offer student and faculty mixers, study spaces, and easier access to tutoring, mentorship, and the various science clubs on campus. Moreover, the STEM center would provide opportunities for community outreach for both students and faculty.

We also plan to continue our efforts in providing research experiences to students to allow them to gain training and connections for their academic and career goals. Similarly, we will continue encouraging application to scholarship and internship programs, especially for minority or disadvantaged students (such as Project RAISE and UCI Bridges). An important facet of our strategy toward eliminating equity gaps is to provide our students with accessible, relatable information on our field and the career paths available to them. The STEM center would assist these efforts by providing a centralized way for us to contact students and disperse information about opportunities.

In our classes, we will continue to implement equitable grading practices. We also plan to increase our use of the Hornets Tutoring program. Although a number of our challenging majors classes already have

embedded tutors, there are some classes that have not had a tutor recently. High-enrollment nonmajors classes in our department, such as BIOL 101 and BIOL 102, have not previously offered embedded tutoring very often. The tutors hired by our department already represent a diverse grouping of students, and we plan to continue this practice. This will provide a greater sense of belonging to our students, in addition to academic and resume development for the students selected as tutors. Along with tutoring, we also plan to continue and hopefully increase offerings of bootcamps in particularly challenging topics or skills. Examples of bootcamps currently offered include a Mitosis & Meiosis bootcamp for BIOL 101, a preparatory Cell Processes & Genetics bootcamp for students entering BIOL 170, and a science essay writing and study skills bootcamp for BIOL 170. Additional funding for both tutoring programs and bootcamps would be helpful in meeting these goals (see **SAP #1**).

We have sought to provide students a tangible pathway toward higher education and subsequent socioeconomic advancement as early as possible in their academic careers. We have therefore established dual enrollment introductory biotechnology courses at five high schools. Those students are introduced not only to our curriculum but also to the state of modern biology and the career potential our discipline provides. Currently we are only able to teach at two high schools per term. We plan to increase dual enrollment offerings in the future, with the hiring of a new full-time dual enrollment biotechnology instructor (see **SAP #2**). Dual enrollment courses will help introduce students to the college setting before they arrive, help them develop necessary skills before reaching college, and create a welcoming environment for incoming students.

With regard to variability in success rates, our program found that the variability for an individual professor is similar to the rates found across all sections (3.3.1 Bottleneck Analysis). This suggests that factors other than instructor or course policies may also be influencing this metric. To ensure that course policies are not contributing to this variability in success rates, our program has begun conversations to standardize course policies and more widely implement equitable grading practices across sections in several courses. Both BIOL 101 and BIOL 102 have the greatest variability in success rates by section (77% and 67%, respectively). Some of these policies have recently been reshaped to be more equitable by omitting low scores for quizzes and assignments. BIOL 100, 101, 102, and 190 all have the highest variability in success rates by section which may indicate the need for an examination of course policies to see if there are ways to incorporate more equitable grading practices across sections. BIOL 170 is only taught by full-time faculty, making it easier to have discussions on equitable grading practices and to get uniform course policies in case this is one of the reasons for the variability.

Finally, our department has been making strides towards reducing textbook costs, which we plan to continue working towards for the future. Most of our courses currently accept older editions of textbooks rather than requiring students to purchase new books, and do not ask students to use expensive publisher websites. We also reuse the same textbook for our first two majors courses, BIOL 170 and BIOL 272, ensuring that students do not have to purchase as many textbooks. These two classes represent our third and fifth highest enrollment courses. A number of non-majors classes and most biotechnology classes have begun adopting open-source textbooks and other educational resources

(OER) in the last several years. We plan to increase the use of OER in nonmajors classes, further reducing the economic burden of textbook purchases for our students.

3.3 Student Achievement and Pathways

1. *Using the data provided by the OIE, briefly describe how students have moved through the program over the past five years: unit accumulation, prerequisites, corequisites, substitutions, gateway courses, and bottleneck courses. (Not all of these measures apply to every program.)*

Using the data provided by the OIE in 3.3.1 on Gateway Course Information (Appendix A), we can identify a few courses to target with interventions in order to improve student completion and success to allow them to continue on the path. BIOL 102 and BIOL 170 both have high enrollment and low course success rates (50 and 51%, respectively) and low course completion rate (76 and 64%, respectively). Additionally, BIOL 170 has nearly double the rate of students repeating the course (19.4%) compared to the next most enrolled course, BIOL 102 (10.6%). Furthermore, these courses also have the highest rates of withdrawal. Whereas BIOL 101 and BIOL 102 may be taken by non-majors students, BIOL 170 is the first Biology course in the Biology Program major and appears to be a Gateway course or Bottleneck for students entering the Program. BIOL 101, 102, and 170 also appear to have the largest disproportionate impact on low-income students and students of color. The disproportionate impact in the top 5 enrolled courses is about 5-6% for Latinx students and 12.7% for Black students in 101. Most importantly, the gaps found in 101 (n = 443), 102 (n = 323), and 170 (n = 113) account for a large percentage (76.7%) of the disproportionate impact gap for the entire program (total gap, n = 1146) and may correlate with the gaps found for low-income students. Intervention in these courses may help to best eliminate these gaps, and help improve success and completion in Gateway and Bottleneck courses, like BIOL 170. Additionally, we plan to participate in the recommendations set by the Summer Inquiry Group (SIG) and pursue professional learning held by the Instructional Success Team (IST) to address these goals: 1) Becoming an anti-racist campus. 2) Addressing student needs by connecting them to services. 3) Strengthening the Student Experience Through the Classroom (see **SAP #7** and **SAP #8**). 4) Improving Existing Campus Services through the creation of the STEM Center (see **SAP #1**).

2. *For transfer degree programs: Are your current requirements in line with the Transfer Model Curriculum, or have you added extra steps, such as prerequisites? If you added extra steps, please explain.*

The AS-T degree 2-year and 3-year map created with the help of Counseling and Guided Pathways Workgroups has requirements in line with the Transfer Model Curriculum in order to create a clear pathway for transfer. Since our 2017 program review, we have maintained existing articulation agreements with surrounding 4-year institutions and strengthened our bonds to the two geographically closest and statistically most significant universities (CSUF and UCI). The majority of our students are pursuing a degree and/or transfer to a 4-year institution to further their higher education in the CSU and UC systems. About 78% of our students are seeking an AA/AST or intend to transfer and pursue a bachelor of science degree. The number of transferring students ranges from 110 to 175 students per year. Additionally, transfer rates to four-year colleges have increased in the last three years. The

majority of transferring students (64%) attend CSUs and UCs, with the most common transfer institution being CSU Fullerton by a large margin. These findings are in accord with the general rate of interest in a degree or transfer for Fullerton College (77%) and suggests our ADT is working as intended and helping students transfer efficiently to a four-year institution.

BIOL 170 accounts one-for-one with transfer courses to the CSU system and only has a basic math prerequisite to help students access the AST path more quickly. This means there are no prerequisites or additional steps to enter the pathway except for MATH 40. Additionally, our AA and AS degrees have more flexibility by offering a choice of upper-level majors courses that fulfills requirements for transfer to the UC system. This allows students transferring to the UCs to reduce the number of credits needed for successful completion of those programs. We will be mapping the AA and AS degrees with the help of Guided Pathways workshops in the near future.

- 3. Please provide an update on the curriculum mapping you have done, perhaps in collaboration with Counseling. Are all programs (degrees and certificates) mapped? Based on course offerings for the last two to three years, could a student complete the map(s) you have created? If so, please demonstrate this with some facts from your schedules. If not, how will you address these discrepancies?*

Using the principles of PSLO Redesign from Guided Pathways, we have created our AS-T 2 year and 3 year maps with help from counselling and the Guided Pathways workgroups. Using this map, a student could have taken these courses to complete the AST in 2 or 3 years with prerequisites/corequisites as we have offered them in the last 3 years. This is because BIOL 101 and all majors courses are offered each semester along with prerequisites MATH 140 and corequisites CHEM 111A. By having offerings each semester, students are able to rejoin the path quickly. BIOL 170 is the bottleneck course for our program and is also taken with CHEM 111A and in our maps requires the most units taken in a semester. It is recommended students take BIOL 101 before BIOL 170 to help students complete the map.

The Biotechnology certificates (and pending AS Biological Technician degree slated to start in Fall 2022) have been mapped. A student is able to finish all three biotechnology certificates in 2 years, as there are no prerequisites. If we change our course offerings to short term courses (**SAP #5**), students may be able to finish even faster.

- 4. Do the data reveal differences among your AA, ADT, or certificate programs (in enrollment, completion, or success, for example)? Please explain.*

Majors courses for the AA, AS, and AS-T have the highest enrollments for our program, and the AA is the most awarded degree. The AS-T was more recently approved and we expect that more of these degrees will be awarded as students transferring into the CSU system apply for this award. Enrollment for our Biotech certificates programs also continues to increase and 25% of program awards since 2018 have been certificates in the Biotechnology program. The main difference between our majors and certificate

programs appears to be that many students who qualify for degrees simply major in biology and transfer on to other institutions without obtaining the AS, AA, or AS-T. The number of awards earned by biology students is consistently significantly lower than the number who could potentially receive awards, largely due to the lack of a standardized system for identifying degree qualification. For example, although BIOL 170 F, BIOL 272 F, and BIOL 274 F have prerequisites and are required for our majors, they do not show more than 67% majors enrollment (See Section 5.1.1), indicating that many *de facto* biology majors may not update their status with the college. The gap between awards earned by biology students and the number who could potentially receive awards is demonstrated by data from 2018-2019, where we saw a large increase in awards earned. This increase was the result of individual biology faculty members tracking course completion by students, and directly assisting qualified students in filing for awards. A system is needed to automatically award qualifying students degrees and certificates based on successful course completion. Identification of students who could earn awards would be improved by such a software system (see **SAP #1**).

3.4 Faculty

1. *Using the data provided by the OIE, briefly describe the faculty workload over the past five years: FTF (full-time faculty), PTF (part-time, or “adjunct” faculty), FTEF (full-time equivalent faculty), WSCH per FTEF (weekly student contact hours). (Not all of these measures apply to every program.)*

The number of full-time faculty (FTF) has declined from a high of 16 in AY 17/18 to 13 today as a result of faculty retirements. We also anticipate that in the next one to two years, two of our faculty will either take full retirement or phase-in retirement. Consequently, there has been an increase in part-time faculty, up to 11 in AY 19/20. (Please note that there is an error in the data provided by the OIE which shows only six part-time faculty in 20/21, while the actual number was 9, with the decline caused by high schools cutting some of our dual-enrollment classes for pandemic-related reasons).

The data provided by the OIE on the percentage of sections taught by full-time vs part-time faculty does not reflect the actual situation because of the way we teach our BIOL 101 classes. The course is a combined lecture and lab, and the instructor teaching the lecture (typically a full-time faculty member) is considered the instructor of record, but most of the labs are taught by adjunct faculty, and because they are not the instructor of record, they are not counted in the data provided by the OIE. By our own estimates, over 40% of our sections are taught by adjunct faculty, and this proportion will likely increase as full-time faculty retirements come into effect.

There has been a decrease in WSCH per FTEF over the past five years, from 542 to 500, partly due to the decline in BIOL 101 enrollment and an increase in small-section Biotech courses for our certificate program. However, FTEF increased from 36.2 to 38.1 in 19/20, before declining in 20/21 due to pandemic-related cuts in sections. Meanwhile, fill rate has remained relatively steady until last year when we were unable to take students above the seat capacity in the high-demand majors classes that purchased lab kits for students.

- 2. If your department plans to request hiring a full-time faculty member, this is the place to make the argument. Please discuss hiring needs in reference to data analyzed in sections 3.1 to 3.4.*

The Biology Department is currently requesting two new full-time faculty members: an organismal biologist to teach BIOL 170 and a new dual-enrollment biotech instructor who can also teach dual-enrollment Human Biology courses (see **SAP #2** and **SAP #3**).

The addition of another organismal biologist to our department will address the persisting student demand for BIOL 170, the gateway course for all biology majors (see **SAP #3**). Ideally, the new faculty member would also be able to teach the marine biology courses that we are currently unable to offer for lack of a specialized instructor. As projected in our last program review, our department had two full-time faculty members retire in the last 4 years. We now anticipate an additional organismal biology faculty member will begin phased-in retirement in 2022. These faculty members taught high-demand classes that met academic major and/or general education requirements, including BIOL 101 General Biology, BIOL 141 Marine Mammal Biology and Conservation, BIOL 170 Organismal Biology, and BIOL 222 Marine Biology. These courses served students pursuing the Biology AA and AS-T degrees. We remain unable to offer BIOL 141 and BIOL 222 due to lack of faculty to teach those courses. Meanwhile, of particular concern is the availability of BIOL 170 sections to biology majors, as discussed in Section 3.1.

In SAP #2, we are requesting a new dual-enrollment instructor who could teach dual-enrollment in both BIOL 190/190L (Introduction to Biotechnology) and BIOL 102 (Human Biology). We see increasing our dual-enrollment classes at local high schools as an important step towards reducing the equity gaps discussed in Section 3.2. In their 3-year study of 3,000 students from dual enrollment programs across California, Hughes et al. indicate that underrepresented and underachieving students benefit from exposure to career-oriented college curriculum (Appendix C). We hope that by introducing high-school students and their parents to our certificate and degree pathways, they will feel a greater sense of confidence and belonging when they come to Fullerton College. Dual-enrollment biotech students will also be able to finish their Level I biotech certificate during high school or within their first year at FC. The students may also be able to gain employment within their field of study while continuing their studies at FC and reduce the equity gap for low-income students.

As discussed in Section 3.1, our Biotech program on campus is also growing rapidly and we are working on offering more sections of the BIOL 190/190L courses on campus starting in Fall 2022. We anticipate our collaboration with the Department of Administration of Justice that will direct students interested in the application of biotechnology in crime scene investigations (**SAP #4**) will also augment our program's growth rate. We also anticipate one of our biology/biotechnology instructors will be retiring within the next two years, creating a need for our remaining biotechnology faculty to teach more upper division biology courses. Thus, with two upcoming retirements, a need to reduce the equity gap for low-income

and Latinx students, and the high demand for our majors courses, we see an urgent need to hire both an organismal biologist and a dual-enrollment biotech/human biology instructor.

3.5 Covid-19

Using the data provided by the OIE, briefly describe how the Covid-19 pandemic affected your department and how your department has adjusted. Did you make temporary changes? Or have you adopted new, long-lasting practices that enhance teaching?

The Biology Department's response to the pandemic has reflected the core values of Fullerton College and our commitment to serving the community. Our immediate reaction to the pandemic included donating our stocks of personal protective equipment (PPE) to St. Jude Medical Center when there was a supply shortage in local hospitals and care facilities. We also established safety protocols allowing us to continue offering in-person, on-campus courses that required critical hands-on experience.

We noted 298 fewer enrollments in AY 20/21 compared to AY 19/20, representing an 8.9% reduction in enrollments that corresponds to a 6.1% reduction in unique students ("head count"). There are several reasons for these results, and we believe that the COVID-19 pandemic played a significant role in generating these figures. First, the lockdowns due to the pandemic resulted in virtually all college campuses pivoting to fully remote instruction with both synchronous and asynchronous courses. This meant that geographic location and convenience (length of commute, timing of class sessions) were no longer limitations for students and they could select a general education course from any number of colleges that met their degree requirements while accommodating their new circumstances. Second, some students experienced employment and/or health insecurity either personally or through a close family member, and thus delayed their education. Third, some students were unwilling to enroll in courses due to technological obstacles they faced, despite our best efforts and despite the concerted response of the campus community; others may have simply preferred to wait for in-person instruction to resume. Finally, due to COVID-19 safety protocols, we were unable to offer the BIOL 196 Tissue Culture Methods course because of the physical space limitations of the small room (~20 m²) and specialized equipment that could not be moved. Our space allocation request for the new CTE building includes a dedicated area for expanded tissue culture facilities.

Our department has taken several measures to ensure students continue receiving quality instruction through the pandemic. For BIOL 101 General Biology, virtual laboratories were introduced that allow the students to collect and evaluate data for the necessary experiments while the students are working remotely from their computers. For the core sequence of biology majors (BIOL 170, BIOL 272, BIOL 274, BIOL 276), we introduced take-home kits with supplies and reagents so that students could complete the required exercises. Analogous kits were introduced for BIOL 190L students. These measures have allowed us to continue offering these courses while remote instruction is necessary.

Courses such as BIOL 191 Biotechnology A - Basic Laboratory Skills and BIOL 192 Biotechnology B - Protein Biochemistry train technicians for biotechnology laboratories, including those laboratories that

are directly involved in the response to the pandemic. Properly trained biotechnicians are vital to the US economy and to US public health. We therefore continued to offer the laboratory components of these courses in person throughout the pandemic. In order to do so safely we have developed COVID-19 protocols in accord with CDC guidelines and industry best practices, and we have continued to train all students in the proper use of personal protective equipment (PPE) in the laboratory environment. In parallel we have reduced section sizes to 18 students, ensuring students can maintain CDC-specified distances between one another in our laboratory classrooms yet still benefit from in-person, hands-on instruction. We have used adjacent laboratory spaces as “staging” areas to maintain safe distances between students, and our instructors have split classes into lab section cohorts so that all students get access to the laboratory room yet CDC guidelines are observed. Following the same logic and employing the same safety precautions and training, we also offered sections of BIOL 272 Cell Biology in-person on-campus throughout the pandemic. As of this writing, the experience we gained with BIOL 191, BIOL 192 and BIOL 272 on campus under pandemic conditions has allowed us to expand our in-person biotechnology course offerings to include BIOL 193 Biotechnology C - Molecular Biology during Fall 2021.

Several of our students are now utilizing their hands-on skills in COVID-19 labs. Importantly, our program has remained accessible to students who wish to obtain a certificate or complete their training in order to enter an academic or industrial laboratory and/or transfer to another institution. The long-lasting practices that we are adopting as a result of the pandemic are thus related to the expansion of the PPE training and safety training we provide our students for the emerging post-COVID-19 era. These techniques are arguably effective and have proven to be a valuable, marketable addition to the skillsets of our graduates. Interestingly, we have noted the presence of returning students who have already earned a B.S. or higher degree and are enrolling specifically for the hands-on training that we continue to provide.

In addition to ensuring continuity in hands-on lab instruction, students and faculty have relied on technology to facilitate student learning in the pandemic. While teaching in a remote fashion, each student is equipped with a computer/mobile device that can be harnessed for student assessment and group collaboration. Faculty used various apps, programs and strategies to keep students engaged in lectures in real time, foster collaboration amongst students, and assess student understanding. For example, the use of Google slides for group collaboration and Google Pear deck for real-time interactive presentations allowing students to comment, work a problem, respond to a prompt allowed faculty to reach all students. While many of these students would never raise their hand in class or may shy away from participating in group discussions, technology allowed all students to have a voice. Thoughtful use of technology coupled with face-to-face learning may serve as a long lasting strategy that should be used in post pandemic teaching. K-12 education uses this model of teaching well, and many of our students are comfortable engaging in this format. They often benefit from 1:1 device to student ratio as early as kindergarten and throughout their K-12 career. We are therefore requesting support for devices so that we can continue to provide these effective pedagogical aids in the post-pandemic era. See **SAP #7**.

3.6 What has not been asked?

Please tell us about other ways your department has been successful, ways that the previous questions might have missed.

Our faculty have offered guidance and mentorship to many students, and we continue to see our graduates succeed in transferring to 4-year institutions nationwide. In addition to leading the state in transfers to CSUF, we also have students who transfer to UC campuses across the state and to public or private institutions across the country. Even during the pandemic, FC biology students participated in 15 undergraduate research projects and internships sponsored by Caltech, CSUF, Cornell, Dartmouth, UCI, USC, and Whittier College. Many FC biology alumni finish their undergraduate education and move on to professional schools or graduate schools (27 alumni earned a PhD). We have expanded our instructional venues to include local high schools and have established promising dual enrollment agreements with those institutions. We have hosted numerous outreach events to engage the community and elucidate the opportunities provided by studying biology. We collaborate with the FC Science Club and have invited our past graduates as speakers, so that current students can hear about career and educational pathways from professionals with whom they may readily relate. We have sought to familiarize students with modern science and the people who practice it, and have held open-house events where students can meet our faculty and establish mentorship. As part of the Natural Sciences Division, we participate in a regular seminar series where FC and visiting faculty present their research, and we have guided students on research projects that have led to distinctions and presentations at conferences as well as publication.

These activities introduce our students to the practices and choices necessary for a successful career in biology while providing them experiences intended to accelerate their progress, initiate networking opportunities, and help bridge achievement gaps while addressing potential inequities our students may face due to their socioeconomic or educational backgrounds.

4.0 Outcomes

4.1 Program Student Learning Outcomes (PSLOs)

Since the last self-study, the College adopted new Institutional Student Learning Outcomes (ISLOs) and new design principles for PSLOs. Please describe your department's PSLO revisions to date, and your PSLO plans.

PSLO revisions for the Biology AA and AST are ongoing. Both programs are in the top 50 awarded programs and have been prioritized. Two PSLOs are in the approval process, and a third PSLO in development should be ready by December 2021. Revisions for the Biotechnology certificates will be addressed in Spring 2022. The department conducted robust discussions on the topic, format, and assessment method of each PSLO revision; this dialog was initiated during the Guided Pathway planning meeting that occurred pre-COVID and will continue until completed, sometime in 2022.

The two revised PSLOs for the Biology AA and AST are:

1. Demonstrate an understanding of how the scientific method is used to explore topics in biology by designing and carrying out their own experiments and communicating their results to the scientific community.
2. Analyze the impact of human activities on natural environments in order to understand and respond to global systems challenges including climate and health concerns, and loss of habitat and biological diversity.

We will continue our discussions to add and refine our PSLOs.

4.2 PSLO Assessment

The new PSLO [design principles](#) encourage departments to use PSLOs as a way of gauging student learning once they have completed a degree or certificate, not just when they have completed a single course. Please describe how PSLOs are assessed or will be assessed in your department.

We have discussed evaluation strategies for both PSLO 1 and PSLO 2. PSLO 1 lends itself easily to a capstone or group project. For example, students could design and conduct a guided experiment in one of our capstone courses (BIOL 272, 274, 276), and then present the results and conclusions in the form of a scientific paper or lab report, poster, slide show, or presentation to their classmates. Such an evaluation scheme would reflect closely the real-world mechanisms that scientists employ to communicate their findings to one another and/or the public.

Discussions regarding assessment of PSLO 2 included the possibility of some sort of reflective paper or project. The issues described in PSLO 2 are subjects of great research activity and discoveries are both numerous and frequent.

Both assessments can take advantage of modern technology and be included in a student ePortfolio. Such ePortfolios can then serve as resources for our students as they continue pursuing their academic or professional goals.

4.3 CSLO Assessment

Briefly describe the timeline your department uses to assess CSLOs on a regular basis and how you use the results to make improvements. This discussion should be based on SLO data, which is available on eLumen. (Your division's SLO reps can help with this.) Please include relevant CSLO charts or graphs in an Appendix. Since the last self-study, you should have assessed the CSLOs of every course that you have taught, at least once. If that is not the case, please describe how you will accomplish this as soon as possible.

During the past 5 years, most of our courses (BIOL 101, BIOL 102, BIOL 104, BIOL 109, BIOL 170, BIOL 190 and 190L, BIOL 191, BIOL 192, BIOL 194, BIOL 272, BIOL 274) have exhibited a regular assessment pattern. Our future evaluation of CSLOs for other courses, including BIOL 101H, BIOL 102L, BIOL 193, BIOL 196, and BIOL 276 can benefit from more regular CSLO assessment.

COVID-19 created a drastic reduction in CSLO assessment during the Spring 2020 semester, which saw our instruction pivoting to a remote delivery format from March to May 2020. Our department invested significant effort and planning to adjust our pedagogical approaches and provide necessary learning materials (“lab kits”) and our CSLO assessment has increased since the initial COVID-19 outbreak as most of our classes evolved into a hybrid/remote format while others resumed normal operation on campus (Table 2)

Table 2. Number of CSLO Assessments Completed by Semester

Semester	n
S 2016	936
F 2016	271
S 2017	112
F 2017	66
S 2018	558
F 2018	635
S 2019	484
F 2019	273
S 2020	51
F 2020	342
S 2021	309
Average	367

The department will establish a regular CSLO assessment schedule and coordinate with full-time faculty so that CSLOs are evaluated in a timely fashion. Full-time faculty are also encouraged to work with adjunct faculty to assess those courses that are taught by adjunct instructors.

4.4 SLO Equity Analysis

1. *Looking at CSLO attainment data, do you find significant differences by race, ethnicity, gender, and other categories? Please include some illustrations of this data in the Appendix. Describe here what the data shows. What strategies will you use to close the attainment gaps among groups of students? What kinds of professional learning would help?*

CSLO assessment data from 2016-2021 are summarized in Tables 3-5. Table 3 shows the results based on ethnicity for the non-majors courses, with BIOL 101 and BIOL 102 accounting for most of the SLOA assessments. Table 4 shows the results for all biology courses taken together, also based on ethnic identity. Table 5 shows CSLO assessment results based on economic status. Note that in assessing these data, we assume the category Y reflects students who qualify as economically disadvantaged. However, it is not known how a student qualifies for inclusion in this category.

Table 3. SLOA Achievement for Biology Non-majors Courses 2016-2021 by Ethnicity

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
African American	61.3%	46	38.7%	29
American Indian/Alaskan Native	91.7%	11	8.3%	1
Asian	83.9%	843	16.1%	66
Filipino	74.1%	109	25.9%	38
Hispanic	74%	1070	26.0%	376
Pacific Islander	75%	9	25.0%	3
Unknown/Unspecified	86.5%	32	13.5%	5
White Non-Hispanic	79.1%	394	20.9%	104

The first conclusion to be made is that there is no significant difference in CSLO attainment between the students in the non-majors classes compared to all students as a whole. This is a reflection of high quality instruction in both majors and non-majors courses alike.

The ethnicity breakdown in Table 4 shows evidence of achievement gaps. The average CSLO attainment for all groups is 76.7% and most groups are fairly close to that average; for example, Filipino, Hispanic, and Pacific Islander students are slightly below, while Native American/Alaskan Native, Asian, and White students are above the average attainment level. The group that deviates most significantly are African American students, with only 63.1% CSLO achievement. However, sample size is definitely a limitation

for accurately assessing this group, since only 105 assessments were recorded in 5 years. Therefore, the department needs to work harder at recruiting African American students for careers in the biological sciences and healthcare. See the Equity Action Plan in Section 3.2.4 for methods the department will employ to improve outcomes for underperforming students.

Table 4. SLOA Achievement for All Biology Courses 2016-2021 by Ethnicity

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
African American	63.1%	67	36.9%	38
American Indian/Alaskan Native	88.9%	16	11.1%	2
Asian	83.9%	634	16.1%	122
Filipino	75.2%	164	24.8%	54
Hispanic	73.8%	1540	26.2%	547
Pacific Islander	71.4%	10	28.6	4
Unknown/Unspecified	90.0%	54	10.0	6
White Non-Hispanic	78.3%	608	21.7%	168
Average – all groups	76.7%	3093	23.3%	941

Table 5 shows no significant difference in SLOA achievement between students who qualify for disadvantaged economic status.

Table 5. SLOA Achievement for All Biology Courses 2016-2021 by Economic Status

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
Unknown	76.3%	2455	23.7%	761
Y (Economically Disadvantaged Status?)	78.0%	650	22.0%	183

2. Compare the equity analysis in this section to the equity analysis in Section 3.2. Are there some groups who have lower completion and success rates AND lower SLO attainment rates than other groups? Can new departmental strategies close both gaps? Please explain. [For example, many departments found that their SLO attainment gaps are quite a bit smaller than their

success gaps (or the gaps do not exist). This might mean that many students who get a D or lower in a course are actually learning the material (i.e. attaining the SLOs) but they are winding up with a failing grade for other reasons: absences, tardies, missed assignments, missed exams, poor performance on high-stakes assignments.]

Comparing CSLO achievement data to department success numbers shows that CSLO achievement is generally higher than course success (Table 6). This could be explained as evidence of learning for students (i.e. attaining the CSLOs) who ultimately ended up getting a D or F in the course for other reasons: absences, tardies, missed assignments, missed exams, poor performance on high-stakes assignments, etc., or it could be explained by the fact that most CSLOs are assessed near the end of the semester when many students with poor performance have already left the course, leaving mostly C and better students to take the assessment. It is probably a combination of both factors. Either way, the achievement gap for most groups disappears when looking at CSLO attainment (see 4.4.1); unfortunately African American students struggle in both measures of achievement by a disproportionate amount. See Section 3.2.4 for plans to support underachieving students.

Table 6. Comparison of CSLO achievement to success 2016-2021

Ethnicity	CSLO Achievement	Success
African American	63.1%	54.1%
Asian	83.9%	71.8%
Native American/Alaskan Native	88.9%	66.7%
Filipino	75.2%	65.7%
Hispanic	73.8%	56.2%
Pacific Islander	71.4%	56.4%
White Non-Hispanic	78.3%	69.3%
Unspecified/Unknown	90.0%	62.8%

5.0 Other Areas of Program Effectiveness

5.1 Your Department and General Education

1. Using the data provided by the OIE, please look at students who take your courses for GE credit.

The data provided from the OIE indicates that 96.4% of our course enrollments are GE enrollments while only 3.6% are non-GE enrollments. While some of our courses fulfilling GE requirements are required

courses for the major (BIOL 170 F, BIOL 272 F, and BIOL 274 F), the other courses are used to fulfill GE requirements for non-Biology majors.

The data indicate that there are three tiers of Biology courses fulfilling GE requirements. We will consider these separately.

Tier 1: BIOL 100 F, BIOL 101 F, BIOL 101HF, BIOL 102 F, and BIOL 102LF. These courses do not have prerequisites and are not required for our majors. These courses were designed to provide a means for non-Biology majors to fulfill their GE requirements. As such, they show low enrollments of majors students (less than 10% for all except BIOL 101 F at 14%). In fact, our majors do not get credit for these courses as they take the higher level Biology courses. These courses show low enrollments for first-time students, even though they have no prerequisites. This indicates that the demand for these courses is high and only those students with higher registration priority are able to enroll.

Tier 2: BIOL 104 F, BIOL 109 F, BIOL 141 F, BIOL 190 F, BIOL 190LF, and BIOL 222 F. These courses do not have prerequisites and are not required for our majors. Since these are more specialized courses than those in Tier 1, they show 25-43% majors enrollment. BIOL 104 F (10%) and BIOL 222 F (15%) show the highest first-time enrollments of all of our courses fulfilling GE requirements. BIOL 222 F is also noteworthy because despite showing the highest first-time enrollment statistic of all our GE courses, we have been unable to offer the course since AY 18/19 due to a faculty retirement. Our intention and request to add a faculty member with the background necessary to teach BIOL 222 F are elaborated elsewhere in this document (**SAP # 3**).

It should be noted that although BIOL 190 F: Introduction to Biotechnology and BIOL 190LF: Introduction to Biotechnology Laboratory are listed here because of the reference to biotechnology, the curriculum is similar to that in the BIOL 100 F and BIOL 101 F courses.

Tier 3: BIOL 170 F, BIOL 272 F, and BIOL 274 F. These courses have prerequisites and are required for our majors. As expected, these show 57-67% majors enrollment. BIOL 170 F and 272 F are popular courses and are posing staffing challenges for our department because we anticipate the retirement of two senior faculty members who teach each of these courses; similarly to the situation with BIOL 222 F, our reasoning for recruiting new faculty to teach these courses is elaborated elsewhere in this document (**SAP # 3**).

2. What role does your department play in helping students complete the GE pathway?

Our Tier 1 courses listed above account for 76% of the total enrollments. The Biology Department has compelling and diverse course offerings for non-majors wishing to fulfill their GE science requirements. We continue to offer discrete lecture or lab sections in parallel with combined lecture/lab courses to serve the GE needs of as many Fullerton College students as possible. Toward that end we have distributed the scheduling of our courses to include early mornings, late evenings, and weekends in an

effort to accommodate students with varied availability due to professional, family, personal, or other educational obligations. As described in Section 3.5, we have also maintained a broad selection of course offerings despite the COVID-19 pandemic. Our faculty and staff have generated and distributed take-home lab kits and have adapted our GE curriculum in order to continue serving the community remotely. As of this writing we are taking the steps necessary to return the majority of our GE courses to their pre-pandemic, on-campus status by leveraging the pathway established by those biology courses that have maintained an on-campus presence throughout the pandemic; we do so in accord with current administrative and regulatory guidelines.

3. *Do you offer GE courses at a variety of time slots and at a frequency that allows students to fulfill GE requirements?*

Our course offerings are scheduled to provide majors and non-majors alike the opportunity to advance toward their certificate, degree, and/or transfer requirements efficiently. We continue to consider non-traditional students, displaced homemakers, working community members, and students with a variety of other obligations and backgrounds when designing our course schedule. We consistently offer courses fulfilling GE requirements during the summer and have used classroom, resource, and instructor availability to generate class schedules that are varied and maximally accessible.

We offer all our Tier 1 courses at a variety of time slots. For those courses in this tier with only a lecture requirement (BIOL 100 F and BIOL 102 F), the evening enrollment is 22-27%. BIOL 101 F is a lecture/lab course but we still have 17% evening enrollment. Our Spring 2022 schedule will continue to provide students many time slot options. For example, we will offer BIOL 100 as a hybrid course to maximize its availability. BIOL 102 sections will be offered online, via remote instruction, and also on campus (in the evening after traditional work hours) to accommodate as many students as possible. An accompanying laboratory course to BIOL 102, BIOL 102 LF, will be offered in four sections spread across three days and including a section commencing at 18:00 for students with obligations during the day. We will offer 13 sections of BIOL 101 with lecture and lab sessions spread across all weekdays and starting times varying from 08:00 to 18:00; furthermore, BIOL 101 labs are also offered on weekends. All the above courses are offered throughout the academic year and also routinely during summer sessions.

Tier 2 GE courses we will be able to offer in Spring 2022 include BIOL 109 and BIOL 190/190L. BIOL 109 is offered as a hybrid course with an on-campus, in-person component but also as an online class in order to maximize its availability to students; the online offering accounted for 76% of enrollments during the last 5 years. BIOL 190 is offered as a hybrid and is also offered as a dual enrollment option after traditional secondary school “bell schedules” that can vary from campus to campus but usually end after 15:00. We offer the above courses throughout the academic year and also offer course selections during summer sessions.

Tier 3 GE courses we have scheduled for Spring 2022 include BIOL 170, BIOL 272, and BIOL 274. BIOL 170 sections will be offered throughout the day, four days per week. BIOL 272 sections will be offered on

two different days, with sections during mornings, afternoons, and evenings to accommodate as many students as possible. Characteristically, our OIE data indicate the evening sessions of BIO 170 F accounted for 28% of enrollments while evening BIOL 272 F sessions accounted for 19% of enrollments over the assessed five-year period. Consistent with our commitment to course availability, BIOL 274 is offered four days a week.

We are facing challenges in our efforts to continue offering GE courses throughout the week. We are therefore requesting additional full time faculty members so that our department can restore our marine biology curriculum and once again offer BIOL 222. We are also concerned with our continued ability to offer 170 sections and 101 sections due to imminent retirements combined with increased demands on the time of existing faculty; likewise, our BIOL 272 sections will be impacted as a result. These issues are discussed in the relevant portions of this document.

4. *Please take into account daytime, evening, weekend, and online classes to provide a brief sketch of your GE course availability.*

We strive to provide GE courses at different times and via different formats. The two Tier 1 lecture-only courses have high online enrollments (BIOL 100 F, 53% and BIOL 102 F, 20%). As mentioned in 5.1.3 above, we offer our largest Tier 1 courses during evenings and have included weekend offerings as well. For example, for the first mostly on-campus semester since the pandemic, Spring 2022, we will offer BIOL 100 as a hybrid course, BIOL 102 online (20% enrollment previously), via remote instruction, and also on campus during the evening (22% enrollment previously), and BIOL 102 LF will be offered in four sections on three days and including an evening section (12% previous enrollment). We will offer 13 sections of BIOL 101 with lectures and labs spread out during weekdays at times from 08:00 to 18:00 (17% evening enrollment previously) and we will also offer lab sections on weekends. We have offered BIOL 190 F and BIOL 190 LF on Fridays, and we have also offered BIOL 190 F through dual enrollment.

During summer sessions, we also routinely offer sections of BIOL 100, 101, 102, 109, 170, 190, and 190L.

5.2 Outside Influences on Your Department

1. *Describe any laws, regulations, trends, policies, procedures, or other influences that have an impact on your program. Please include any other data that may be relevant to student achievement, learning, and trends within your Basic Skills, CTE, or Transfer Education programs.*

Biotech Growth and Dual Enrollment

From the inception of our biotechnology certificate program in 2016, we have seen a dramatic increase in enrollment in courses required for our Lab Assistant Skills Certificate. The courses, which include BIOL 190 and 190L (Introduction to Blotechnology lecture and lab), as well as 191 (Basic Skills), have seen tremendous growth in course enrollments between AY 16/17 and AY 19/20. Over the 4 year period pre-covid, enrollment in BIOL 190 increased 64%, BIOL 190L increased 73%, and BIOL 191 increased 49%. One of the driving forces behind this increase is the implementation of dual enrollment biotech courses

starting in AY 18/19. BIOL 190 and 190L were being offered in 4 high schools each academic year. In the first year of implementation, AY18/19, we saw an increase in enrollment of almost 40% for both BIO 190 and 190L compared to AY 17/18.

Biotechnology Pathway K-12 to Community College

An overall trend of broad interest in biotechnology in K-12 education is being observed in Orange County. The Anaheim Union School District, our dual enrollment partner, is currently investing and strengthening their Biotechnology curriculum and pathway, starting as early as junior high school. Biotech faculty have served as advisors for the creation of this K-12 pathway and curriculum, to encourage and allow high school students a pipeline directly to Fullerton College. The North Orange County Regional Occupational Program (NOCROP) which services the Anaheim Union High School District; Brea Olinda Unified School District; Fullerton Joint Union High School District; Los Alamitos Unified School District; and Placentia-Yorba Linda Unified School District are also seeking to expand K-12 CTE Pathways through grant funding. NOCROP had met with the Fullerton College biotechnology faculty to discuss course articulation and close collaboration. These investments in K-12 CTE programs and curriculum could result in increased demand for FC biotechnology courses over the next five years.

Tracking Earned Certificates

Our biotechnology program offers a 3 tiered, stackable certificate model for our students. While we have seen enrollment increasing in our biotechnology courses, the number of awarded certificates has not increased to the same degree. One logistical problem is that students that are earning their certificates are not actually being awarded their certificates. The spike in biotech certificates in AY 19/20 was driven by faculty reviewing rosters and confirming all eligible students applied for their earned certificate. We are not effectively capturing and awarding all eligible certificate holders. Students must complete an application for each separate certificate at the end of the semester in which they will complete the requirement. Upon completion, students often think that their accomplishment will automatically be noted on their transcripts. We need infrastructure/software at the collegiate level that will automatically determine if the correct courses have been taken and immediately award the student their certificate (**SAP #1**). An automatic award option upon completion as opposed to an “opt in” model, allows the process to be more equitable to all students. As many of our biology majors transfer without program awards, this software would also help determine if transfer students should be awarded associate degrees in biology and interdisciplinary studies.

- 2. Make sure you are including all degree and certificate programs, including the College's GE program.*

N/A; our GE requirements are sufficiently diverse that students have ample opportunities to fulfill them with GE courses from other departments. We also constantly monitor program changes that might impact our GE offerings.

3. *Please also consider not only your courses, but also prerequisite and corequisite courses that might be offered by a different department.*

Our prerequisite and corequisite courses are in chemistry, physics, and mathematics. The chemistry department has increased offerings and our students are not impacted; prerequisite physics and mathematics classes are also widely available.

4. *If AB 705 applies to the program then how are you meeting its mandates?*

N/A

5.3 Your Program's Active and Applied Learning and High-Impact Practices

1. *The College wants to create an inventory of faculty efforts to make learning active and applied. Please briefly describe opportunities your students have to apply and deepen knowledge and skills through projects, internships, co-ops, clinical placements, group projects outside of class, service learning, study abroad, and other experiential learning activities that you intentionally embed in coursework, or elsewhere in your program.*

Active and Applied Learning and High Impact Practices used in Biology courses include flipped classroom format, real-time class polling, group projects, boot camps, service learning projects, oral presentations, digital portfolios, hands-on skills assessments, and projects that mimic industry supply chain projects or university research laboratories.

- The **flipped classroom** format of the BIOL170 (Organismal Biology) has students watch recorded lectures before coming into class for discussion, group activities and real-time polls and quizzes. The flipped classroom thus allows for the incorporation of more critical thinking activities. It also allows instructors time to answer individual questions from students whereas in a traditional classroom, the entire 2-hour lecture is taken up with doling out information. It has been found that student engagement with content has increased because of the flipped classroom format along with improved faculty contact time with students, all of which enhance learning.
- **Live classroom polling** is used in most biology classes. This allows participation by all students and the instructor can see students' responses and explanations. This helps to see where students may have misconceptions regarding content, or not understand material.
- **Service Learning** project in BIOL 101HF, one assignment is titled "Improving the Commons". Student teams identify, plan, coordinate, and implement an improvement project of a commons in the community. Some teams have joined an organized beach or park clean-up. Other teams have put together the entire activity themselves. The students document their efforts and produce a brochure for distribution about the commons and the improvement effort.
- **ePortfolio** (or digital portfolios) are currently being used in several biotechnology courses to show proficiency in techniques via flip grid videos, samples of scientific writing and presentations.

- **Field Trips** are offered in multiple courses, as experiential learning helps students better connect theories and knowledge learned in the classroom and from textbooks to the real world. In-person and virtual tours of biotech industry companies allow students to explore careers in the biotech industry and network. BIOL 101 (General Biology) offers 3 field trips a semester including the Fullerton Arboretum, Sage Scrub, and Tide Pools. The two field trips in the BIOL 170 (Organismal Biology) provide students a unique opportunity to apply conceptual content learned in the classroom to a real life setting- a cornerstone of instruction in any Biology class. The field trips allow students to visually experience and learn concepts regarding the evolution of plants and animals across various phyla. In BIOL 274 (General Ecology), students get the opportunity to spend a weekend in the Colorado Desert while working on field research projects that they later present in both written and oral formats.
- **Hands-on Skill assessments.** Biology students typically apply and reinforce concepts learned in lecture by performing lab experiments. Students in BIOL 170 frequently use microscopes, perform dissections, and examine specimens to demonstrate appropriate laboratory techniques and apply biological concepts. However, many of our specimens are deteriorating, and we would like to update our specimen collections to support improved hands-on learning in our courses (see **SAP #8**). Students in BIOL 190L, 191, 196, and 272 are assessed on specific hands-on skills to show proficiency, safety, and proper techniques needed in today's workforce. These skills are important for employability and third-party certification (see **SAP #10**). For BIOL 196 (Tissue Culture), each student uses a Go Pro camera to record their cell manipulation technique, which allows the instructor to provide custom feedback. All of our biology courses require additional support from our lab prep room, equipment, and staff (see **SAP #6**).
- **Group projects and oral presentations** are integrated into BIOL 101H, 104, 190L, 192, 193, 272, 274, and 276. These assignments are relevant for practicing communication skills and teamwork.
- **Mimic biotech industry laboratory setting.** BIOL 191 and 297 offer training that simulates the real-life working conditions of an academic or industrial biology laboratory. Student teams must work collaboratively and cooperatively, and learn how to work, think, interact, and conduct themselves like professional scientists. FC faculty run a **Biotech Supply Chain Project**, in which student interns work full days in an industry-type setting producing and packaging lab reagents. Students learn about the procedures, logistics, quality assurance and documentation used by the biomanufacturing industry. These skills are particularly in demand during our response to the pandemic, and the reagents produced are used in campus courses, local high schools, and outreach events. This training is unique in our area and instills in students both the skills necessary to be productive in a working environment but also a tangible sense of responsibility and pride in their work since they are not involved in merely a lab exercise but rather an actual production process.
- Pre-semester **boot camps** are offered to incoming BIOL 170 students. These camps are conducted by faculty before the semester starts. The two boot camps offered help students get caught up with basic biological concepts like cell structure and transport and also help students learn the art of scientific writing. **Boot camps** for mitosis/meiosis are offered mid-semester to

BIOL 101 students after these concepts have been discussed in class. Students that attend these bootcamps report enhanced understanding of the concepts.

2. *Are there institutional barriers hindering your department's ability to offer or enhance these learning experiences for students? Please explain.*

Barriers to Internships and Research

- Space on campus to house interns and have dedicated research space for students. The classrooms that house all of our research equipment are used for classes continuously. We have few options for dedicated lab space to carry out research projects and house interns, besides weekends. (See Section 6.3 Long-Term Plans)
- Funding for students to participate in internships/research (See **SAP #9**). Many of our students work while attending classes. While many students can benefit from internships and research opportunities, many of these positions are unpaid. Providing a stipend for students to conduct research or intern in their field of study would allow access to more students and provide an equitable framework for students to take part in these activities.

Classroom structure/arrangement/technology (see SAP #7)

- Many of our science classrooms are not conducive to collaboration.
- Long tables as opposed to circular tables for easier interactions
- Technology available to instructors and students while teaching could enhance high impact practices and learning experience for students. For example, the ability to move about the room while lecturing while writing notes on an ipad and projecting to the screen as opposed to standing at the front of the room writing with my back to students.
- In addition, platforms that work well for engagement like interactive slide decks, polls, collaborative group work that can be seen by the instructor in real time, all require technology such as tablets or devices that have internet access. These tools need to be available to instructors and students to maximize teaching effectiveness as this provides feedback and assessment in real time.

6.0 Planning

6.1 Progress on Previous Strategic Action Plans

1. *Please briefly describe the goals (Strategic Action Plans, SAPs) from your last self-study. How much progress have you made on them? If you have reached a goal, explain how it allows ongoing improvement, especially if you received additional funding.*

SAPs from 2017 Self-Study

2017 SAP 1: Create a Campus STEM Resource Center.

- Progress was not made on the SAP. The long-term success of this goal will depend on the college's commitment to STEM education and the funding of a resource center. This SAP will continue as the new 2021 SAP #1.

2017 SAP 2: Update Bioscience A.S. degree program and create a 4th Biotechnology certificate.

Goals of SAP 2: *We will revise the AS degree requirements for better articulation with the Biotechnology Bachelor degrees currently offered at two California community colleges.*

- The update of the Biotechnology Technician Associate's degree in CurricUNET is pending approval for Fall 2022. Proposed course changes in the degree align with the courses offered in our stacked certificate program as well as the courses needed for articulation into Biotechnology Bachelor degree programs offered at two California Community Colleges.

We are developing a new Biotech Research and Development Certificate, which would include new courses in research skills, science seminars and STEM internships.

- We are having ongoing discussions with the regional Biotech Industry Advisory Board, regarding the need and demand for a Biotech Research and Development Certificate program. The BIOL 297F: Biosciences Internship course, launched in Fall 2021, supports work experience that is directly related to the student's area of study in Biology or Biotechnology.

2017 SAP 3: Increase opportunities for students to experience science through research, internships, field trips, etc.

Goals of SAP 3 : *We will offer research opportunities in the life sciences that will provide students with training that is not normally available at community colleges.*

- Five students have participated in the "Ants of Southern California" research project over the past four years. The project is now entering a new expanded phase via a partnership with Oak Canyon Nature Center in Anaheim Hills to help them document biodiversity within the park. This new arrangement will allow us to offer research opportunities to many more students than the ants project, and broaden our taxonomic focus and implement a more multidisciplinary approach that will appeal to students with diverse interests and goals.
- **56 FC** students have participated in **83 bioscience internships** since 2017. These include 23 at UCI (mainly Biomedical Research), 7 at CSUF (Project RAISE), 16 at FC (4 ant research project, 3 supply chain project, 9 tutor), 8 at Amgen Biotech Experience, 10 in industry, 7 at other universities, and 6 at other agencies.
- Local biotech industries have provided internships for FC students, including Gene Wiz, Truesdail Labs, Amgen Biotech Experience, Eurofins, Applied Biomedical, Inscent, AIH Labs, WCCT Global, and Westox Labs Irvine.
- FC students have participated in summer research internships at universities (CalTech, Cornell, CSUF, Dartmouth, U Colorado, UCI, UCR, USC, Whittier College).

- We will continue to seek and form partnerships with local life science and health industries to provide internship opportunities for our students, as we meet with a Biotech Industry Advisory Board each year.
- As a capstone to their research and internships, students will participate in the annual Natural Sciences Undergraduate Research Symposium, and may submit posters for presentation at scientific conferences in Southern California, including the Southern California Conference for Undergraduate Research, and the Southern California Academy of Sciences annual meeting.
- By offering students an opportunity to jumpstart their scientific careers, we hope to attract a greater number of majors, increase the number of Biology degrees attained, and increase the number of transfers from our department to four-year institutions.
- The proposed Campus STEM Resource Center and Director (see **SAP #1**) will help coordinate research and internship opportunities.
- We will need an additional supply budget to accommodate the increased number of students at the Undergraduate Research (see **SAP # 9**).

2017 SAP 4: Repair and Restore the Native Plant Garden, water feature and greenhouse

- The College has no interest in restoring the Native Plant Garden to a working state.

2017 SAP 5: Increase the mentoring role of faculty with our biology major students

- Over 200 students have been mentored by faculty since 2017.
- We will survey students in our Cell and Molecular Biology (BIOL 272) and General Ecology (BIOL 274) courses to determine their career goals. Subsequently, students will be matched with a faculty mentor with expertise that aligns with their stated career goals. Faculty members will help and encourage students throughout their tenure at Fullerton College. They will help students find appropriate external learning opportunities as research assistants or interns.
- We will continue with our biannual Biology Majors Mixer.

2017 SAP 6: Create a Division Internship Coordinator position

- Position not created
2. *If additional funds were NOT allocated to you in the last review cycle, how did the LACK of funds have an impact on your program?*
- Community college students do not have the same access to research programs and internships as their counterparts from four-year institutions, putting them at a disadvantage. The lack of funding for a STEM Center and a Division Internship Coordinator has therefore meant that our students do not enjoy the same access to research/internship experiences as their peers who are at universities (see **SAP #1**).

6.2 New Strategic Action Plans

Please write brief, concrete plans that you will accomplish over the next four years. Your plans might include requests for additional funds. The Program Review Committee will read these and either endorse the request or ask for more information. Please keep in mind that the Committee's endorsement does not guarantee additional funding. The President's Advisory Council and Faculty Allocation Committee play major roles in allocating funds and prioritizing new faculty hires.

Please number each of your plans. This will help keep track of them. Also, make sure that each funding request includes the following elements:

- 1. It is supported by the data and analysis in previous sections of this self-study.*
- 2. It fulfills a part of the [College mission, vision, goals, or objectives](#).*
- 3. It explains how the request helps the College attain student equity.*
- 4. There is a measurable way to tell if the extra funding will be effective.*
- 5. It considers whether you can reach this goal (or parts of it) without additional funding.*
- 6. Please give a dollar amount, or best estimate. If you can identify a funding source, then please name it. If you can put the request into one of the following categories, please do so: Personnel, Facilities, Equipment, Supplies, Computer Hardware, Computer Software, Training, Other.*

Strategic Action Plan (SAP) # 1, CREATE A CAMPUS STEM RESOURCE CENTER with Director,

Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>The proposed Campus STEM Resource Center will require a full-time classified staff member to run the Center, and suitable facilities to house it. There are several possible locations for the Center, which include the land adjacent to the native plant garden and the former Math Lab in the 600 building.</p> <p>The director of the Center would have the following duties:</p> <ul style="list-style-type: none"> ● Identify STEM majors and develop database for tracking ● Develop a contact folder and meet with STEM majors once a semester. ● Identify potential majors and recruit them ● Assist STEM majors with an educational plan, resume, and statement of purpose. ● Coordinate with Institutional Research and Basic Skills offices to identify trends and opportunities ● Match STEM majors with faculty mentors for increasing college connectivity ● Identify scholarship, internship, and employment opportunities in STEM fields ● Develop “environmental scan” (job market) in LA/OC ● Identify, promote, and assist undergraduate research opportunities ● Assist STEM majors with applications for scholarships and internships ● Update STEM calendar of events ● Develop/maintain/update STEM website ● Manage STEM tutors hiring/scheduling ● Assist with tutoring and supplemental instruction ● Develop and assist with STEM-experience activities ● Act as liaison between STEM programs ● Act as liaison with CSU/UC STEM departments ● Coordinate STEM seminar series ● Develop funding opportunities for STEM ● Communicate/market STEM programs to campus and community
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT Objective 1: Create a clear pathway for every student Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p>

	<p>GOAL 2: CULTIVATE A CULTURE OF EQUITY</p> <p>Objective 1: Remove institutional barriers to student equity and success</p> <p>Objective 3: Increase outreach to and recruitment of students from underserved populations</p> <p>Objective 4: Foster a sense of belonging where all are welcome and student basic needs are addressed</p> <p>GOAL 3: STRENGTHEN CONNECTIONS WITH OUR COMMUNITY</p> <p>Objective 1: Create and expand partnerships with local K-12 and higher education institutions</p> <p>Objective 2: Create and expand relationships with local businesses and civic organizations</p> <p>Objective 3: Be a cultural hub for the local community</p> <p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 3: Provide professional and career development opportunities for students, faculty and staff</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● A STEM Center provides an “one-stop shop” with easy access to STEM and CTE counselors, tutors, faculty mentors, group advising and many resources ● Promote more collaboration between STEM faculty and counselors regarding best practices for a student’s schedule based on course difficulty, work schedule, and other factors ● Provide a location for STEM tutors (Hornet Tutors or science PAL Tutors) ● Provide a welcoming and inclusive environment for students, tutors, faculty and counselors to interact, thus providing a more integrative, comprehensive and inclusive campus climate that could help to reduce race-based achievement gaps
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Increased number of STEM degrees/certificates ● Increased number of STEM majors transferring ● Increased recruitment of underrepresented groups to STEM majors ● Increased success rate of STEM students ● Increased persistence and retention of STEM students ● Increased number of students attending tutoring and SI sessions ● Creation of a STEM Alumni Network ● Increased placement of students in research and internship programs ● Increased opportunities for students to participate in community service ● Increase the amount of grant money to support student/faculty research opportunities ● Greater connectivity and partnerships with area STEM industries ● More interdisciplinary coordination among STEM departments

What specific aspects of this SAP can you accomplish without additional financial resources?	This plan is highly dependent on funding and facilities.
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If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	\$87,000/yr. ongoing	General Fund
Facilities	\$150,000	Measure J Bond or Carryover
Equipment	\$10,000	Instructional Equipment Funds
Supplies	0	
Computer Hardware	\$3,000	Instructional Equipment Funds
Computer Software	0	
Training	0	
Other	0	
Total Requested Amount	250,000	

Strategic Action Plan (SAP) # 2: New Full-Time Dual Enrollment Instructor, Department Name: Biology

Describe Strategic Action Plan.	<p>There has been strong demand for our dual-enrollment BIOL 190/190L (Introduction to Biotechnology lecture/lab) at local high schools, which has been beneficial for program growth, as mentioned in Section 3.1. However, we have had to limit our offerings of these classes to 2 high schools per semester to ensure that we can staff and carry out the labor-intensive lab preparation for these courses. We also anticipate offering more BIOL 190/190L courses on campus due to the pending collaboration with the Administration of Justice department (see SAP#4), and an upcoming retirement of one of our Biology/Biotechnology instructors in the next two years, putting further strain on our program. In addition, we anticipate introducing BIOL 102 (Human Biology lecture) as a dual enrollment course in the future.</p>
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	<p>To maintain high quality instruction at our dual enrollment sites, a full-time dual enrollment instructor is needed to teach these courses across our school sites (see Section 3.4). Having a dedicated faculty member to teach dual enrollment courses, collaborate with FC outreach efforts, and spearhead equipment delivery and use will allow our program to grow and flourish, and strengthen this pathway for students from high school to college.</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities Objective 3: Improve student critical thinking skills Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>GOAL 2: CULTIVATE A CULTURE OF EQUITY</p> <p>Objective 1: Remove institutional barriers to student equity and success Objective 2: Increase equity in hiring and training</p> <p>GOAL 3: STRENGTHEN CONNECTIONS WITH OUR COMMUNITY</p> <p>Objective 1: Create and expand partnerships with local K-12 and higher education institutions</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Provides stability and consistency of dual enrollment courses to be held on high school campuses ● Course with cutting edge equipment and high impact practices to be held for free on high school campuses ● May allow for expansion of dual enrollment offering to other feeder high schools ● Each high school has different student populations with very unique needs. A full time instructor will allow for equity training and professional development opportunities that can be utilized long term for each high school dual enrollment course ● Allows the instructor to more clearly understand the unique needs of each high school, and strengthen pathways leading to FC
<p>What measurable outcome do you</p>	<ul style="list-style-type: none"> ● Hiring of a full time faculty member ● Increase in dual enrollment offerings of BIOL 102, 190, 190L

anticipate for this SAP?	<ul style="list-style-type: none"> • Increase in student success and retention
What specific aspects of this SAP can you accomplish without additional financial resources?	This plan is dependent on funding.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	67,769 - 96,485	General Fund
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	67,769 - 96,485	

Strategic Action Plan (SAP) # 3: New Full-time Biology Instructor (Organismal Biology), Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>The Biology Department has experienced high demand for both general education and majors courses in parallel with faculty retirements that have generated difficulties in staffing key courses to meet student needs. These concerns were also noted in our 2017 program review. We now propose hiring an organismal biologist to address the persisting student demand for our organismal biology course that is a requirement for biology majors. Ideally, the new faculty member would also be able to teach marine biology courses that we are currently unable to offer for lack of a specialized instructor (see Section 3.4).</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT Objective 2: Enhance workforce training opportunities Objective 3: Improve student critical thinking skills Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>GOAL 2: CULTIVATE A CULTURE OF EQUITY Objective 1: Remove institutional barriers to student equity and success Objective 2: Increase equity in hiring and training</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Allows more students to enroll in high demand course needed to complete their major ● Use equitable practices in hiring new faculty to strengthen our diverse department ● Allows for variety in courses in marine biology that may appeal to different students
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Hiring of a full time faculty member ● Reinstate offering BIOL 141 and BIOL 222 ● Open more Sections of BIOL170 to meet student demand ● Increase in student success and retention

<p>What specific aspects of this SAP can you accomplish without additional financial resources?</p>	<p>This plan is dependent on funding.</p>
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If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	67,769 - 96,485	General Fund
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	67,769 - 96,485	

Strategic Action Plan (SAP) # 4: Collaboration with Administration of Justice Department,

Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>Collaborate with the Administration of Justice Department to offer the Bio 190L class for a cohort of Crime Scene Investigator students, with priority registration each year. Our faculty will author an OER Biotechnology lab manual with CSI storylines.</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities</p> <p>Objective 3: Improve student critical thinking skills</p> <p>Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Provides cross collaborative educational experience ● Cohort approach provides support and community for students ● Provides biotechnology skills in the context of the crime scene lens ● Allows students to be better prepared and more competitive for employment or transfer ● Provides a diverse group of faculty across disciplines
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Priority registration for a cohort of students majoring in Crime Scene Investigation (CSI), starting Fall 2022 ● Creation of a free OER Biotechnology lab manual, that focuses on real-world CSI applications and cases ● Professional development for faculty on current techniques used in CSI and police departments ● Increase in student success and retention with tutors
<p>What specific aspects of this SAP can you accomplish without additional financial resources?</p>	<ul style="list-style-type: none"> ● Priority registration for a cohort of students majoring in Crime Scene Investigation (CSI) ● Creation of free OER Biotechnology lab manual, that focuses on CSI applications and cases

- The cost of the BIOL 190 Lab supplies will be covered by the AJ Department

Strategic Action Plan (SAP) # 5: Offer Biotechnology Courses as Short-Term Classes,

Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>As we mapped our tiered biotech certificate pathway, it became apparent that completing our 3 biotech certificates takes longer than desired. This is primarily due to the fact that as our program grows, we can only offer our upper division courses once a year. This often results in students primarily completing our first certificate, then transferring or getting a job before they can complete all courses in our higher level certificates.</p> <p>In addition, we would like to capture other populations in need of highly desired industry skills such as tissue culture training and protein purification. This includes post-baccalaureate students, and current employees looking to advance in their companies or labs. To allow for students to gain critical, high demand industry training quickly, we would like to offer these high impact courses in an accelerated 8-week format.</p> <p>Based on input from our yearly Biotech Industry Advisory Meeting, tissue culture training is in high demand. This class lends well to an 8 week format, as students require extensive repetitive training in specialized biosafety cabinets. In addition, they are manipulating living cells which require consistent and proper maintenance. Students would be able to take 2 courses in 1 semester, thus decreasing the time needed to complete a certificate, degree or transfer.</p> <p>Tissue Culture can be combined with other courses to create various 2 course combinations. Potential options for 8-week course combinations include:</p> <ul style="list-style-type: none"> • 8 week Bio 191 followed by 8 week Bio 196 tissue culture class • 8 week Bio 196 tissue culture class followed by 8 week Bio 194 Quality course • 8 week Bio 191 followed by 8 week Bio 192 Proteins • Summer 5 week Bio 191 followed by 5 week Bio 196 tissue culture
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<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities</p> <p>Objective 3: Improve student critical thinking skills</p> <p>Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Allows students to complete a degree or certificate in a shorter amount of time ● Provides high impact opportunities to students early in their career preparing them for transfer or employment ● Allows advanced, hands-on learning, in small supported classrooms.
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Increase in enrollment in courses transitioned to 8-week format ● Increase in tier 2 and tier 3 biotech certificates ● Increase in Biotechnology Technician Degrees ● Increase in postbaccalaureate enrollment in biotech courses ● Increase the number of students in Biotechnology and Bioscience jobs ● Increase the number of industry and academic partners
<p>What specific aspects of this SAP can you accomplish without additional financial resources?</p>	<ul style="list-style-type: none"> ● Courses can be transitioned to the 8-week format ● An additional Guided Pathway map for Biotechnology certificates and AS degree can be generated with the shorter format

Strategic Action Plan (SAP) # 6: Update High Use Biology Prep Room/Lab Room Equipment,

Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>As mentioned in Section 3.1, enrollment in our biology majors courses has increased over the last 5 years. In addition, the biotechnology program was implemented in 2016, with 7 new courses being offered yearly. Properly functioning equipment used daily by our laboratory prep room personnel is critical to ensure all reagents needed for all biology classes can be made.</p> <p>We only have 1 shared autoclave for sterilizing materials and reagents needed on a daily basis in all biology/biotechnology lab courses. This particular piece of equipment is experiencing many issues due to age and use. In addition to a new and reliable autoclave, we are in need of a replacement deli refrigerator used to house reagents in our lab classroom. Our current lab refrigerator is extremely loud, making it difficult for instructors to hear students in class.</p> <p>These pieces of equipment are central to preparing, sterilizing or storing reagents for the majority of our courses. If our autoclave were to malfunction beyond repair, this would be catastrophic for the majority of our courses. Taking a proactive approach and replacing these equipment BEFORE they stop working allows continuity of courses.</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Allows all students access to consistent, hands-on lab experiments ● Ensures students have access to all reagents needed ● Supports increased use of high-impact, hands-on classroom practices in all Biology courses
<p>What measurable outcome do you anticipate</p>	<ul style="list-style-type: none"> ● Students will be better able to hear the instructor ● Students and faculty will have reliable access to sterile media and reagents as necessary

for this SAP?	
What specific aspects of this SAP can you accomplish without additional financial resources?	This plan is dependent on funding.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment	Autoclave \$30,000 Lab Refrigerator \$8,000 Shaking Incubator \$5,000	SWF Funding for one equipment
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	43,000	\$8,000

Strategic Action Plan (SAP) # 7: Update Classroom Technology for Student Assessment and Collaboration, Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>As many faculty were forced into the world of online teaching during the pandemic, we implemented many useful technological applications as mentioned in Section 5.3. Students equipped with a computer and internet proved to be powerful tools to promote best practices for student/student interaction, student/instructor interaction and real time student assessment. In classrooms with 24 plus students, it is difficult to assess students in real time, provide collaborative assignments that can be viewed by all students and instructors simultaneously, and collect and analyze data. We would like to transition this amazing use of technology into our face-to face classes. Specifically, we would like to purchase 5 classroom sets of laptops for laboratory classes taught across our department. These laptop carts can be securely stored in each labroom. All students will be equipped with laptops for group projects via google or microsoft teams. Students can utilize installed software to collect and analyze data, view images and structures in a 3-D format, contribute to class discussions, answer questions in interactive slide decks and fully utilize technology for enhanced engagement, critical thinking, and class communication.</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities Objective 3: Improve student critical thinking skills Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p> <p>GOAL 2: CULTIVATE A CULTURE OF EQUITY</p> <p>Objective 1: Remove institutional barriers to student equity and success Objective 4: Foster a sense of belonging where all are welcome and student basic needs are addressed</p> <p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs</p>

<p>Explain how the request helps the College attain student equity.</p>	<p>Provides all students with technology in class.</p> <ul style="list-style-type: none"> ● Many of our students do not have the financial means to purchase devices for home or classroom use ● Allows ALL students to participate in real time ● Supports widespread application of active learning practices ● Allows immediate feedback to instructors regarding learning in real time ● Allows instructors to identify common misconceptions, difficulties in data analysis in real time, with the ability to offer student support ● Contributes to collaborative work and group communication allowing for students to feel more connected
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Implementation of more collaborative projects ● Increase in use of interactive assessment tools in class ● Improvement in campus climate ● Increase student success and retention
<p>What specific aspects of this SAP can you accomplish without additional financial resources?</p>	<p>This plan is dependent on funding.</p>

<p>If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.</p>		
Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment	\$2000 x 5 lockable computer cabinets	
Supplies		
Computer Hardware	\$700 x 24 laptops x 5 lab rooms	

Computer Software		
Training		
Other		
Total Requested Amount	\$94,000	

Strategic Action Plan (SAP) #8: Replace Models and Expand Specimen Collections and Manipulatives for Biology Courses, Department Name: Biology

Describe Strategic Action Plan.	Our biology students study the living world through various hands-on labs activities (Section 5.3). These labs require extensive collections of diverse organisms, models, and manipulatives to offer students an appropriate laboratory experience. We would like to replace deteriorating specimens as well as expand our collections. This would impact the following courses: BIOL 101, 102, 102L, 104, 170, and 274.
List College goal/objective the plan meets.	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities</p> <p>Objective 3: Improve student critical thinking skills</p> <p>Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>GOAL 2: CULTIVATE A CULTURE OF EQUITY</p> <p>Objective 1: Remove institutional barriers to student equity and success</p> <p>Objective 4: Foster a sense of belonging where all are welcome and student basic needs are addressed</p> <p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs</p>
Explain how the request helps the College attain student equity.	<ul style="list-style-type: none"> ● Promotes high impact practices in courses with equity gaps ● Supports hands-on classroom activities and skill assessment in Biology courses ● Increases student interest and engagement in laboratory activities

What measurable outcome do you anticipate for this SAP?	<ul style="list-style-type: none"> • Improve student success and retention • Improve course completion
What specific aspects of this SAP can you accomplish without additional financial resources?	This plan is dependent on funding.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment		
Supplies	100,000	Lottery Money and General Fund
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	\$100,000	

Strategic Action Plan (SAP) # 9: Funding for Research Projects, Department Name: Biology

Describe Strategic Action Plan.	<p>Hands-on, hypothesis driven, research projects are a fundamental tool we can use to engage students, promote mentoring, and improve campus climate amongst our STEM students. We envision a broad department collaboration to encompass various “types” of research conducted in a multidisciplinary way. Our biology majors have broad interests, but we can harness this to allow collaboration and expansion of learning opportunities. FC faculty have already piloted a research project at Oak Canyon Nature Center allowing our students to collect and study organismal biodiversity at the preserve. DNA extracted from organisms collected in the field would be sequenced and compared to national databases for species identification. Collaboration between students with various interests and skill sets toward a common project will help reinforce concepts and skill sets, while providing students with hands-on critical thinking opportunities, and the ability to contribute to novel scientific research locally.</p>
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	<p>As mentioned in Section 3.2.2, the largest equity gaps exist for Latinx and Black students as well as low-income students. Many of our students may be less likely to participate in unpaid internship opportunities as they need to have paid employment. Offering our research interns an hourly wage could help promote equity in the group of students participating in our projects. Students would now have the opportunity to earn money for themselves and/or their families while gaining valuable experience in their field of study. This experience would make our students more marketable for future employment in the biosciences industry and university research settings.</p>
<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities</p> <p>Objective 3: Improve student critical thinking skills</p> <p>Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness</p> <p>Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p> <p>GOAL 2: CULTIVATE A CULTURE OF EQUITY</p> <p>Objective 1: Remove institutional barriers to student equity and success</p> <p>Objective 4: Foster a sense of belonging where all are welcome and student basic needs are addressed</p> <p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Promotes high impact practices in courses with equity gaps ● Promotes collaboration and individualized support and mentoring
<p>What measurable outcome do you</p>	<ul style="list-style-type: none"> ● Improve student success and retention ● Improve course completion

anticipate for this SAP?	
What specific aspects of this SAP can you accomplish without additional financial resources?	This plan is dependent on funding.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	10 Student hourlies (\$15-17hr) X (10hrs/week) x (16 weeks) \$27,200/semester x 5yrs	SWF Funding for biotech projects Private Foundation awards General Fund? Future NSF S-STEM application?
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	\$272,000	

Strategic Action Plan (SAP) # 10: Host Regional Biotechnology Credentialing Assessments,

Department Name: Biology

<p>Describe Strategic Action Plan.</p>	<p>Although Fullerton College awards the biotechnology certificates and AS Biological Technician degree, some of the industry employers continue to require a Bachelor degree in biology for employment. A third-party, industry-recognized, validated practical skills assessment or credential may demonstrate the competency and skill sets of our students to the industry employers. We anticipate that FC students who earn these credentials will appear industry-qualified and more likely to gain bioscience employment. We hope that as more FC students and alumni earn these credentials, more partnerships can be built with local employers. These credentialing exams may also encourage current students to complete the biotechnology course series and certificates.</p> <p>Fullerton College was chosen by the CCC Statewide Director of Life Sciences and Biotechnology to be one of four new California testing centers for the Biotechnician Assistant Credentialing Exam (BACE). As part of a three year NSF-ATE grant, we will provide the nationally-recognized, industry-driven, third-party certification exam on biotechnology knowledge and lab skills to regional college and high school students.</p> <p>Students can also be assessed on practical skills and earn micro-credentials authenticated by the Bioscience Core Skills Institute (BCSI). Jo Wu will train to be a BCSI Tiers 1 and 2 evaluator, and test students from three other OC college biotechnology programs. FC students will be tested by Santiago Canyon College faculty. Kim Rosales and Spiros Dimitratos will train to be Tier 3 and Tier 4 evaluators on specialized equipment in future years.</p> <p>FC faculty also teach BIOL 194: Quality and Regulatory Compliance in the Biosciences, which helps students with the topics covered in the Certified Quality Improvement Associates (CQIA) exam from the American Society of Quality.</p> <p>FC faculty will prepare and compile resources to help students prepare for these assessments. As the exam fees are high, we plan to use grant funding to help pay for FC students that are well-prepared for the assessments. We will use NSF and SWF grant funding for the next three years, and plan to apply for the federal Perkins grant for future certification fees.</p>
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<p>List College goal/objective the plan meets.</p>	<p>GOAL 1: PROMOTE SUCCESS FOR EVERY STUDENT</p> <p>Objective 2: Enhance workforce training opportunities</p> <p>Objective 4: Increase completion of courses, certificate and degree programs, and transfer-readiness.</p> <p>Objective 5: Encourage completion of degrees for students enrolled in Career Technical programs</p> <p>GOAL 3: STRENGTHEN CONNECTIONS WITH OUR COMMUNITY</p> <p>Objective 2: Create and expand relationships with local businesses and civic organizations</p> <p>GOAL 4: COMMIT TO ACCOUNTABILITY AND CONTINUOUS QUALITY IMPROVEMENT</p> <p>Objective 3: Provide professional and career development opportunities for students, faculty and staff</p>
<p>Explain how the request helps the College attain student equity.</p>	<ul style="list-style-type: none"> ● Provide credentialing fees for well-trained students
<p>What measurable outcome do you anticipate for this SAP?</p>	<ul style="list-style-type: none"> ● Improve student success and retention ● Improve course completion ● Increase the number of students in Biotechnology and Bioscience jobs ● Increase the number of industry and academic partners
<p>What specific aspects of this SAP can you accomplish without additional financial resources?</p>	<ul style="list-style-type: none"> ● Faculty compiling exam resources and practice questions ● Faculty training to serve as exam proctor and site administrator ● BACE fees for 45 students over 3 years, paid by NSF grant ● BCSI fees for 45 students in 10 credentials over 3 years, paid by SWF funds

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel		
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training	\$400 /BCSI training x 3 faculty	Local SWF funds
Other	\$150 /BACE x 15 students x 3 years \$20/BCSI x 15 students x 10 credentials x 3 years	NSF- ATE grant pays for BACE Local SWF funds pay for BCSI
Total Requested Amount	\$10, 950	\$10,950 from grants

6.3 Optional: Long-Term Plans

Your department might have more plans than just immediate requests for funding. If so, please describe them here.

- Once the pending Horticulture/Applied Sciences Center is built, the biotechnology program plans to move equipment and courses out of the 400 South Science building. With the new building, there will be more space available for teaching the biotech courses, and for teaching clean-room gowning procedures. Furthermore, the tissue culture lab will be much closer to the main teaching lab (instead of being on a different floor). We do anticipate needing a full-time lab technician who will prepare and support the Anatomy/Physiology/Biotechnology lab courses.
- Shared lab stockroom equipment includes an autoclave, dishwashing station, freezers, refrigerators, chemical storage cabinets, and water purification system.
- Close proximity and future collaborations with the Horticulture department may lead to a short term course in Plant Tissue Culture techniques or Agricultural Biotechnology.
- Close proximity and future collaborations with the Foods and Nutrition department may lead to new courses on Food Science Technology and Fermentation, as patterned by other biotechnology programs in the state.
- As several lab rooms on the second floor of the 400 building will be vacated (with the exodus of Anatomy/Physiology/Biotechnology), this provides the capacity to increase course offerings in the high demand BIOL 101, 170, and 27x majors courses.
- Ideally, one vacated lab room could be designated for biology research projects. In the past decade, some FC research projects could only be conducted on Fridays and Saturdays, due to

space limitations. There is only one hallway lab bench in the 400 building available to multiple research students, outreach assistants, and supply chain interns. It would be more efficient if students had more dedicated space for their research specimens, microscopes, and instruments. Moreover, we could have more students working collaboratively on a project together.

- As the biology/biotechnology faculty have been successful in bringing in about \$3 million funds and supplies to Fullerton College over the last two decades, we plan to continue to apply for state, federal and private funding to support our research projects, internships, and career technical programs. We welcome and need the district grant-writing and accounting support.
- One possible federal grant opportunity is the NSF S-STEM, which provides \$600,000 to the college for STEM scholarships to students with financial need and high academic potential. The grant also pays for mentoring, tutoring, internships, research projects and other student-centered, success-oriented activities. However, to attain the S-STEM award, multiple departments across the campus would be required to collaborate closely -- including Financial Aid, Counseling, Tutoring, Career Center, Transfer Center, and STEM faculty.

7.0 Executive Summary

Please provide the reader with a brief overview of the highlights, themes, and key elements of this self-study. Please do not include new information you did not discuss earlier. Although you will likely write this section last, please remember to put this summary at the front of your report.

Mission

The Biology Programs support the College Mission, Vision, Values, and Goals in a variety of ways. Science programs promote critical thinking, inquiry and intellectual curiosity, which lead to life-long learning and personal growth. Our programs teach diversity on many levels of life, help students understand growth and change, and hold students to high levels of integrity and ethics. The programs support the college goals by working to increase student retention and success through tutoring, supplemental instruction, workshops, boot camps, seminars, field trips, and summer camps that both inspire and support student success. We reach out to the campus, district and general public with a variety of programs and events.

Students

Although we have seen an overall decline in enrollment over the past five years, due mainly to a decrease in students taking non-majors courses, our fill rates remain strong and enrollment losses have been partially mitigated by increases in biotech and biology majors classes during that same period. The student population in biology courses is broadly representative of the College, however, they are more likely to carry full-time course load.

Completion and success rates remain below College averages, but we achieved a 5% increase in student success since our last program review. This accomplishment is the result of an ongoing effort to

improve our support for biology students. The vast majority of our majors transfer to universities upon completion of our programs. However, one area of concern for us is the low number that apply for and receive degrees and certificates upon transfer. A College or district-wide system to automatically track progress, audit transcripts, and award degrees and/or certificates to qualifying students would be a great improvement on our current system.

Outcomes

The Biology Department is in the process of redesigning our program-level SLOs. To date, we have adopted two new/modified PSLOs and are working on a third. We will continue to add and refine our PSLOs and assessments to better serve our students and the community at-large.

Course-level SLOs are assessed regularly and data show that 77% of our students meet the learning outcomes. Most ethnic groups are close to the average, however, African American students only meet the outcomes about 63% of the time. Because of the low number of African American students taking biology classes, it is hard to determine whether this gap represents a real pattern or simply an anomaly due to low sample size. We will continue to monitor this development and work towards a solution if needed.

Program Effectiveness

Biology courses are an integral part of the College's General Education pathway. The majority of our students are taking biology courses to meet GE requirements. We strive to make our classes accessible to any student that needs to take one. Our courses are offered at a variety of time slots (morning to evening) from Monday thru Saturday. We are also offering an increasing number of dual enrollment courses for high school students.

In addition to making our classes accessible, we implement a wide variety of active learning and high-impact practices. These include flipped classrooms, classroom polling, service learning, research, field trips, boot camps, summer camps, and more.

Planning

Since our last program review we have made significant progress on our previous SAPs, including updating and adding degree and certificate programs, providing research and internship opportunities to students, and mentoring services to biology majors. We have 10 new and/or ongoing SAPs in this current program review, as follows:

SAP 1: Create a STEM Resource Center

SAP 2: New Full-Time Dual Enrollment Instructor

SAP 3: New Full-time Biology Instructor (Organismal Biology)

- SAP 4: Collaboration with Administration of Justice Department
- SAP 5: Offer Biotechnology courses as short-term classes
- SAP 6: Update High Use Biology Prep Room/Lab Room Equipment
- SAP 7: Update Classroom Technology for Student Assessment and Collaboration
- SAP 8: Replace Models and Expand Specimen Collections and Manipulatives for Biology Courses
- SAP 9: Funding for Research Projects
- SAP 10: Host Regional Biotechnology Credentialing Assessments

All of our SAPs will have a positive impact on student success and several of them are strongly tied to equity issues. Beyond our SAPs, our long-term goals include expanding our limited space to better meet the needs of students and increasing our collaborative relationships with other departments.

8.0 Publication Review

The College wants to maintain integrity in all representations of its mission, programs, and services. Please help this effort by reviewing your publications: professional social media profiles, websites, brochures, pamphlets, etc. Please tell us the date they were last reviewed and if you found them to be accurate in all representations of the College and program missions and services. Information on the college's graphic standards is available [here](#).

1. *For each of your program's publications, please provide the URL where the publication can be viewed. If the publication cannot be accessed via the Internet, please contact Lisa McPheron, Director of Campus Communications at lmcpheon@fullcoll.edu.*

As a member of the Natural Sciences Division, our department is well represented online. The division maintains an introductory web page here: <https://natsci.fullcoll.edu/> This web page describes the mission, facilities, programs, degrees/certificates, and curriculum of the various departments within the division. Contact information and links to any online resources provided by individual faculty members are available at this link: <https://natsci.fullcoll.edu/natural-sciences/staff-directory/>.

The biological sciences pathway is directly accessible through this web page. A pathway diagram is available here: https://natsci.fullcoll.edu/wp-content/uploads/sites/70/2019/12/biology_road_map_2019.jpg and the pathway is current for Fall 2021.

The Biotechnology program maintains a robust online presence that serves as an informational hub for current, past, and prospective students. As our CTE (Career Technical Education) program offers tiered, stackable certificates in addition to an AS-T degree, Biotechnology is represented at this site: <https://cte.fullcoll.edu/department/biotechnology/>. The site includes links to each certificate where the requirements are listed, as well as informational links to current industry opportunities for graduates. The site is current for Fall 2021.

From its inception the Biotechnology program has been an integral part of a county-wide, multi-district and multi-campus initiative that has increased community access to high-tech training and other opportunities in the field. This initiative, the Orange County Biotechnology Education Partnership, uniquely coordinates the efforts of all 5 participating community colleges (FC, IVC, OCC, SAC, SCC). This website serves as an outreach and information resource: <https://www.ocbiotecheducation.org/>. The site is current for Fall 2021.

An overview of the Fullerton College Biotechnology's web presence with numerous links is available here: <https://www.ocbiotecheducation.org/fc-biotech-links>. A website focused exclusively on our Fullerton College biotech program is at <https://fcbiotech.weebly.com/> and has been modified for Fall 2021.

- 2. If you find an inaccurate publication, please explain how you will make corrections.*

Inaccuracies in websites will be brought to the attention of the staff or faculty member responsible for that site.

- 3. If your department maintains a social media presence then please describe it here. What do you use it for? How do you monitor it? Who is in charge of it? In what ways is it benefiting the College and your program? Does it follow the [District's social media guidelines](#)?*

All printed and online publications associated with our department meet the NOCCCD Social Media Guidelines as approved by the Chancellor's Cabinet and District Planning Council on 2011-09-26 and by the Technical Advisory Committee on 2011-05-17. All information posted is done so with the approval of the relevant faculty, and all postings are performed by authorized personnel in compliance with all stated guidelines. Where curriculum, department policies/practices, and degrees/certificates are described, the decisions of academic committees and district policies are followed and information is maintained current by the relevant faculty or personnel.

The websites featuring our department are listed above. For more informal but also more frequently updated posts, the biotechnology program has a presence on Instagram, available here: <https://www.instagram.com/fcbiotech/?r=nametag>. The Instagram account is used for outreach and informational purposes and like our other web efforts, content is posted by authorized personnel, follows district guidelines and industry best practices, and is monitored by our faculty. The continued popularity of Instagram as a platform has provided us the opportunity to institute periodic and thematic updates on a regular basis. For example, there is a "Spotlight" feature that focuses on particular alumni and highlights their academic and professional achievements, their impressions of the curriculum, how our courses prepared them for the next step in their career pathways, and relatable advice they may have for current or prospective students interested in our field. For practical advice on procedures and everyday tips from the lab bench, we have "Tip Tuesdays." On "Throw Back Thursdays" the account

features retrospective posts that give brief glimpses into achievements or highlights from the careers or training of alumni, and “Shout Out Saturdays” feature posts intended to recognize current and former students who have achieved various academic/professional milestones.

The Instagram account is maintained by a full-time laboratory technician employed by the Biology Department who is very familiar with the curriculum and has the appropriate technical background, since she is an alumna trained in biotechnology at Fullerton College.

4. If your program regularly communicates with the wider community, please describe how. What feedback do you get from the community?

Feedback we have received to date has been positive, with users commenting on interesting and/or relatable posts. It is our intention that our online presence will provide a platform for us to inform community members of our activities while reinforcing our long-term commitment to serve and educate.

Appendix A: Key Performance Indicator (KPI) data

The Office of Institutional Effectiveness will provide data for departments to analyze. To answer some of the questions on this form, departments will need disaggregated data that focuses on specific groups. The data will be presented to identify equity gaps among groups, so that departments can plan ways to close those gaps. Departments should also be informed how their student populations compare to the overall college population, and the population of the college’s service area.

Appendix A is available at this link:

<https://drive.google.com/file/d/1vHWGN3Nsus-qxfAssSXWAFV3uw5fxksu/view?usp=sharing>

Appendix B: SLO data

This data is still off-limits to the OIE because it is housed in eLumen. The Faculty Senate only allows faculty members to have access to SLO data on eLumen. The Senate’s SLO Assessment Committee will work with its division reps to help departments disaggregate SLO data, just as KPI data is disaggregated in Appendix A.

Biology CSLO Demographics

1. Biology Non-majors Courses 2016-2021 by Ethnicity

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
African American	61.3%	46	38.7%	29
American Indian/Alaskan Native	91.7%	11	8.3%	1
Asian	83.9%	843	16.1%	66
Filipino	74.1%	109	25.9%	38
Hispanic	74%	1070	26.0%	376
Pacific Islander	75%	9	25.0%	3
Unknown/Unspecified	86.5%	32	13.5%	5
White Non-Hispanic	79.1%	394	20.9%	104

2. All Biology Courses 2016-2021 by Ethnicity

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
African American	63.1%	67	36.9%	38
American Indian/Alaskan Native	88.9%	16	11.1%	2
Asian	83.9%	634	16.1%	122
Filipino	75.2%	164	24.8%	54
Hispanic	73.8%	1540	26.2%	547
Pacific Islander	71.4%	10	28.6	4
Unknown/Unspecified	90.0%	54	10.0	6
White Non-Hispanic	78.3%	608	21.7%	168
Average – all groups	76.7%	3093	23.3%	941

3. All Biology Courses 2016-2021 by Economic Status

Category	Meets or Exceeds Expectations	n	Does Not Meet Expectations	n
Unknown	76.3%	2455	23.7%	761
Y (Economically Disadvantaged Status?)	78.0%	650	22.0%	183

Appendix C: Other data

In addition to the KPI and SLO data, departments may wish to include other data that it finds in Tableau or other sources.

Hughes et al., 2012. *Broadening the Benefits of Dual Enrollment*. files.eric.ed.gov/fulltext/ED533756.pdf. Accessed November 10, 2021