

PROGRAM PERFORMANCE REVIEW

Department of Biological Science

Cal State Fullerton

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I. Department/Program Mission, Goals, and Environment

A. Mission and goals of the department.

The Mission Statement for the Department of Biological Science was developed by the Long-Range Planning Committee in accordance with the University's mission and goals and received final approval by the faculty in May of 1996. It continues to guide us in making strategic decisions and remains consistent with the University [Mission and Vision](#) and [Fullerton Forward](#), Cal State Fullerton's 2024-2029 Strategic Plan.

Mission Statement for the Department of Biological Science:

As an integral component of a large, comprehensive, public university, the Department of Biological Science benefits from and contributes to the rich and changing character of California State University, Fullerton (CSUF). Our students, majors and non-majors, undergraduate and graduate, are a cross-section of a diverse population with respect to age, ethnicity, culture, academic experience, and economic circumstances.

Our full-time faculty conducts innovative research across a broad spectrum of the biology discipline that is integrated into our undergraduate- and graduate-level teaching. Faculty research allows our department to serve as a regional center for the scientific study of life processes that provides students with the specialized skills and biology knowledge needed to meet California's workforce demands, including diverse scientific, technological, and medical industries.

Our department embraces the University's mission and works to advance the strategic plan's goals (Fullerton Forward), acknowledging its substance as the underpinning of our mission as a department. Our students are challenged to develop intellectually and scientifically, while being prepared for challenging professions and to work for the betterment of society.

Our faculty and staff: (1) strive for excellence in both teaching and research; (2) actively involve students in scholarly, creative, and collaborative activities in the classroom, laboratory, and field; and (3) affirm that collaborative faculty-student research is an integral and requisite part of learning in the biological sciences.

Our department is committed to equitably implementing these goals and strategies by acknowledging gender, ethnic, and cultural biases and embracing best practices that remove barriers, cultivate a sense of belonging, and promote access and success to all students. We endeavor to maintain an exciting, dynamic, comprehensive, and contemporary educational program in biological science by recognizing our accomplishments, identifying areas for improvement, and responding to new and unforeseen challenges that provoke immediate action to work toward achieving our goals.

While the broad mission of the Department of Biological Science has not changed during the review period, our department has actively contributed to discussions and implementations of plans that align with the CSUF or CNSM goals as they have changed during this time frame. Our goals, as well as the activities in which the department engages, are well aligned with that mission, as well as with Fullerton Forward and the Missions and Vision of CSUF. Whenever CSUF or CNSM goals or strategic plans have changed, our department has actively contributed to the discussions and ensured that our mission and goals are aligned with newer plans. Our department has been a leader on campus in many of the elements of the Strategic Plan, including (a) engagement of students in high-impact experiential learning, (b) implementation of evidence-based programs that support student success and narrow achievement gaps for under-resourced students, such as mandatory advising and Supplemental Instruction (SI), (c) recruitment and retention of high-quality, student-centered and research-active faculty, and (d) securement of external grants and contracts to support our mission and goals. Our department contributes to CSUF's goal of becoming a national model public comprehensive university by striving for excellence in all we do to educate all life sciences students and prepare students for careers and graduate programs in biology-related fields.

Goals of the Department of Biological Science:

1. Curriculum (Aligns with University Goals 1 & 2):

Prepare students to be scientifically literate citizens with the skills and knowledge (e.g., scientific reasoning, teamwork, and critical thinking skills) to facilitate their success in future careers by providing:

- a. Current, rigorous, evidence-based curricula for graduate students, undergraduate majors, and non-majors.
- b. Experiential learning through hands-on laboratory and field activities, including original research, for engagement by students in authentic experiences to learn science by doing science.
- c. Clearly articulated and assessable student learning goals.

2. Student access and success (Aligns with University Goals 1 & 2):

- a. Promote student access and success by optimizing enrollment capacity and student movement through the biology degree programs and our general education (GE) curriculum and service courses.
- b. Promote student success through high-quality academic and career advising and mentorship.
- c. Promote student success by providing high-impact practices (e.g., supplemental instruction, advising, capstone experiences, research, internships) to all biology undergraduate and graduate students.
- d. Encourage engagement of students in departmental and college-hosted events and organizations to build community and cultivate a sense of belonging.

3. Recruit and retain high-quality and diverse faculty and staff (Aligns with University Goal 3):

- a. Continue to hire research-active, student-centered faculty and skilled support staff who will work collegially toward meeting the department's goals.
- b. Advocate for campus resources, including adequate space, facilities, and professional development support for faculty and staff to meet the demands of growing enrollment.

4. External funding (Aligns with University Goal 4):

- a. Increase fundraising through entrepreneurial activities, grants, and contracts that support the department's mission and goals.
- b. Improve tracking and communication with our alumni to maintain connections to the broader community for future support of our program during fund-raising and crowd-sourcing initiatives.

In all these educational endeavors, the department strives to provide excellent learning opportunities that meet the needs of the student populations served, to use student-centered approaches, to develop students' critical thinking skills, and to use assessment to improve.

B. Changes and trends in the discipline and the response of the department to such changes.

Although the core mission and goals have not changed, the department stays abreast of advances in the discipline and biology education. It readily implements new initiatives to enhance student success and meet our mission and goals.

In the previous review period, the department responded to a national movement **to promote inclusive excellence and student-centered, active learning instructional strategies in the life sciences**, led by the American Association for the Advancement of Science (AAAS), the National Science Foundation (NSF), the National Institutes of Health (NIH), the National Academy of Sciences (NAS), the Howard Hughes Medical Institute (HHMI), the United States Department of Agriculture National Institute of Food and Agriculture (USDA NIFA), the American Association of Colleges and Universities (AAC&U), Project Kaleidoscope (PKAL), the American Institute of Biological Sciences (AIBS) and other scientific societies. These efforts are summarized in documents such as [*Vision and Change in Undergraduate Biology Education*](#) and the Partnership for Undergraduate Life Science Education ([PULSE](#)), which outline core biological concepts and competencies for undergraduate programs and emphasize the importance of student-centered, inquiry-based instruction, integration of teaching and research, engaging students in authentic research, early exposure of students to research, building a sense of community and of scientific identity, and assessment of student learning outcomes. CSUF Department of Biological Science members participated in these national discussions, embraced the goals of these initiatives, and led the way in implementing program reforms aligned with these goals and using pedagogical strategies supported by science education research.

Consistent with the Vision and Change goals, we have integrated research and teaching into our curriculum, including the core courses in which students formulate and test hypotheses and investigate open-ended questions. As our undergraduate

student numbers far exceed our capacity for each student to experience research in the labs of our full-time faculty, the department has continued to scale our capacity for experiential learning in faculty research programs through the expansion of our repertoire of courses that function as Course-related Undergraduate Research Experiences (CUREs) that provide high impact practices for student engagement in original research.

In the prior review period, a major initiative aimed at inclusive excellence and student success in the department was the introduction, assessment, expansion, and institutionalization of Supplemental Instruction (SI) based on the University of Missouri, Kansas City model ([UMKC - Supplemental Instruction](#)), starting in 2007 with the first biology core course, BIOL 171, Evolution and Biodiversity, because of the persistent low pass rates in that course. SI is only one of several “interventions” that the department has attempted over the past three decades that has had a positive effect on student success in our introductory course. In 2010-11, SI was expanded to the second core course, BIOL 172, Cellular Basis of Life, which also serves Biochemistry majors and other students preparing for the health professions. Starting in Spring 2014, we were able to offer SI for some sections of our non-majors BIOL 101 course, thanks to support from the Chancellor’s Office (CO) Course Redesign program. An unexpected benefit of SI in Biology has been the impact on the SI student leaders, 58% of whom have gone on to teaching credential, graduate or professional programs. Documenting the impact of SI on the SI leaders and studying how SI impacts students’ content understanding, as well as their attitudes and beliefs about learning, was the focus of a collaborative NSF Improving Undergraduate STEM Education grant involving four of the five departments in the College of NSM. During the current PPR review period, SI has continued with the new first-year course sequence (BIOL 151 and BIOL 152, replaced BIOL 171 and 172, respectively), and was expanded to BIOL 251 - Genetics, another course with lower passing rates, indicating a need for more student academic support.

C. Priorities for the future.

Framing Our Priorities

Our priorities have been shaped in the past by the CSUF strategic plan, as well as the Graduation Initiative from the CSU Chancellor’s Office (GI 2025). During the review period, our department has frequently made quick curriculum changes in response to challenges imposed upon us, with little time for deliberate planning. Our program has faced unexpected challenges of the global pandemic and two years of surging enrollment of first-time freshmen while also transitioning through three department chairs. We are at a stage where long-term planning for our department is needed in a post-pandemic world in which online instruction has been firmly established in our undergraduate curriculum, our campus is juggling the benefits and challenges of the intrusion of artificial intelligence into education, and much of the work of faculty that has shifted online needs careful review and revision for compliance for accessibility under the American Disabilities Act. As for our past planning, which was guided by the mission and goals of our strategic plan, as well as [Graduate Initiative 2025](#) from the Chancellor’s Office, our future planning will be guided by campus priorities described for the next five years in Fullerton Forward and continue to work toward closing achievement gaps and improving our four-year and six-year graduation rates for first-time freshmen and transfer students.

Priority 1

Continuing to implement timely paths to graduation by actively evaluating bottlenecks and revising curriculum to address increasing enrollments of first-time freshmen. It will be important for our program to assess the deployment of our new concentrations to determine if the new paths allow efficient progression of students toward graduation or if additional program reforms are needed.

Supports Fullerton Forward goal 1 and department goal #1.

Priority 2

Conduct a self-assessment of the first-year biology courses (BIOL 151 and BIOL 152) for interventions in declining student success. The increase in our enrollment numbers by our campus Registrar’s Office has led to a decline in the overall preparedness of students for college-level biology, whether due to lowering standards for admission or deficits in learning for cohorts of students still impacted by remote high school learning during the pandemic. It will be important for our program to consider the implementation of interventions and possible benchmarks for students to enter BIOL 151, such as the current prerequisites for entry into the first required chemistry course (CHEM 120A).

Supports Fullerton Forward goal 1 and department goal #1.

Priority 3

Increase student access to experiences in original research by promoting expansion of innovative educational approaches, including CUREs, study abroad partners with a research focus, and online education opportunities, with the objective of getting students involved in research early in their academic careers.

Supports Fullerton Forward goal 1 and 2 and department goal #2.

Priority 4

Develop a diverse and engaging departmental community that builds on the diversity and inclusivity of our existing faculty, lecturers, and staff to support an equitable set of opportunities for both undergraduate and graduate students.

Supports Fullerton Forward goal 3 and department goal #3.

Priority 5

Pursue opportunities for external funding that can support student-centered research department infrastructure, and programmatic initiatives to bolster student success.

Supports Fullerton Forward goal 4 and 5 and department goal #4.

Priority 6

Plan future faculty hiring to reinforce concentrations that have lost faculty due to recent retirements and transfer to administrative positions. Strategic planning of new hires will be important for recruiting faculty that can support the concentrations with the largest needs and possibly attracting faculty who can serve in two concentrations (e.g., Plant Biology, which has two faculty currently in the FERP program, and the new Cell and Molecular Biology concentration, which will have the highest number of students to accommodate).

Supports Fullerton Forward goal 3 and department goals #1 through 4.

Priority 7

Develop a new microcredential curriculum component that allows students to earn digital badges for expertise in commonly used cell and molecular biology lab skills and for development of a research proposal. Create and implement a learn-at-your-own-pace collection of asynchronous learning modules that engage students in analyzing research articles, hypothesis generation, and proposal development focused on stem cell biology through the newly launched iPROSPR (inclusive Pipeline for Research and Other Stem Cell-Based Professions in Regenerative Medicine) program.

Supports Fullerton Forward goal 1 and department goal #2.

Priority 8

An important priority for our department is to revise our tools for assessing faculty instruction. Our program needs to modernize our Student Opinion Questionnaire forms, which have not been updated in over two decades and need to be examined with consideration for eliminating the potential damage of biases and addressing recent changes in instruction, with more instruction implementing online tools with the course management system (Canvas) and addition of new courses that are offered entirely online and asynchronously. Additionally, our campus has updated the University Policy Statement governing the evaluation of lecturers; it will be important for our department to update our document that covers this evaluation process to support our retention of quality lecturers, while implementation of the revised UPS will streamline the review process and lighten the burden of full-time faculty conducting the reviews, which have grown in number with increased student enrollments expanding the number of part-time lecturers requiring evaluation.

Supports Fullerton Forward goal 1 and department goals #1 and 2.

D. Programs offered in a Special Session self-support mode.

The Department of Biological Science does not offer any programs in Special Session self-support mode.

II. Department/Program Description and Analysis

The Department of Biological Science is a large and complex department with numerous majors that has grown significantly over the review period. The department is dedicated to educating the individual student using evidence-based active-learning and inquiry-based approaches. Our mission is to help guide students to acquire diverse skills, develop attitudes, and master the information necessary to continue their education, obtain desirable employment in biology-related careers, and be productive citizens.

The undergraduate curriculum for Biology has long operated by providing all biology majors with broad exposure to fundamental biological principles in the lower division and depth of knowledge within a specialized area of concentration chosen by the student for the upper division. The program engages students in experiential learning through laboratory and field experiences, requires a capstone experience, and is designed to develop skills identified as important by graduate and professional schools and employers (e.g., critical thinking, oral and written communication, data analysis, accessing resources, working in groups, and creativity).

Our department plays an important role in the General Education (GE) program of CSUF by ensuring that students understand important biological concepts and how they are relevant to everyday life, by developing biological literacy, and by providing opportunities for students to explore specific biological topics in greater depth in the advanced GE offerings. The department also offers nine service courses primarily to support students preparing for careers in health and allied health professions or as teachers. The enrollment from GE courses (excluding GE courses in the major) provides roughly 36 % of the department's Full-Time Equivalent Students (FTES) per semester.

The department offers a rigorous thesis-based MS degree program that engages diverse students in faculty-mentored research. Many career opportunities in the sciences require a graduate degree, and the student learning outcomes (SLOs) of our MS program are designed to develop scientific skills and prepare graduates for various careers and graduate or professional schools. Our MS students become experts in their selected area of study based on coursework, seminars, and hands-on laboratory and field research, with this work culminating in a thesis that they present and defend before an examination committee. Many graduate students present their thesis projects at professional meetings and in peer-reviewed publications. Our graduate students have the opportunity to develop their teaching skills through our Professional Aspects of Teaching Biology course (BIOL 500C) and mentorship from faculty laboratory coordinators who oversee graduate teaching assistants. Recent graduates of our MS program have found employment in the region or seek additional education: approximately one-third of MS graduates attend PhD or professional schools, one-third work in industry, consulting, or governmental agencies, and one-quarter of our MS graduates obtain teaching positions. Biology faculty also contribute to mentoring graduate students in other science departments (e.g., Chemistry and Biochemistry) and cross-disciplinary programs such as Environmental Studies as members of thesis committees.

Our faculty is committed to using high-impact practices, including the integration of teaching and research, to provide students with opportunities to learn and prepare for biological careers by participating in faculty-mentored research, internships, service learning, supplemental instruction, and advising. The faculty and staff are collegial, hardworking, dedicated to student success, and contribute to the department, university, and the profession in multiple ways.

Undergraduate Program

A. Substantial curricular changes in existing programs, new programs (degrees, majors, minors) developed since the last program review. Discontinued programs.

B. Structure of the degree program.

During the PPR period, the Biology major's curriculum was extensively redesigned to meet the demands of growing student enrollment by addressing barriers to student progression in the major that include a) course bottlenecks, b) variable offerings of upper-division courses in the concentration, and c) availability of upper-division lab units in the Biology major.

Additionally, the department has addressed Biology curriculum priorities by d) adding requirements for all Biology majors in Evolution and Physiology and e) fulfilling the upper division writing requirement in Biology. The department also participated in curriculum development to f) support retention of first-time freshmen in STEM.

The core courses provide a solid basis for understanding the principles that underlie the many distinct disciplines of biology, and instructional efforts also support development of students to work independently and in small teams in classroom activities or laboratory and field studies to discover information about the biological world. During the previous PPR period, the Biology core courses were reduced from 5 units derived from 3 units of lecture and 2 units of laboratory per week to 4 units by reducing one lab unit. A significant constraint for the number of students who can progress through the Biology major is the number of seats for the laboratory sections that can be offered due to space limitations and room occupancy. Our prior core course redesign tackled separation of the laboratory component from the lecture component for the second-year courses BIOL 251 and BIOL 252, with their co-requisite laboratories BIOL 253L and 254L, respectively. This separation allowed students who only passed the laboratory component to repeat only the lecture component, somewhat relieving this laboratory bottleneck and increasing our capacity to allow more students through the program (see data below in C. and D.).

The Biology full-time faculty collectively decided that the Biology curriculum should universally include instruction in Evolution, so BIOL 325 (Principles of Evolution) became a required course in the Biology major. This new lower-division core curriculum was fully implemented in Fall 2017, and the Evolution requirement for all majors was added in Fall 2018:

BIOL 325: *Principles of Evolution*. Mechanisms of evolutionary change, including mutation, selection, migration, and drift. Introduces methods for studying adaptations. Sexual selection, kin selection and evolution of life history strategies. Uses modern examples, including antibiotic resistance, to illustrate the relevance of understanding evolution. (2.5 hours lecture, 3 units)

In AY23/24, with an unexpectedly large enrollment of first-time freshmen in Biology, the department responded to the unusually high demand for a Biology course in the first semester by quickly revising BIOL 152 to suspend the sequential order for first-year Biology. A significant bottleneck remains in the Biology major in the lower division courses for the two courses with lecture and laboratory requirements (BIOL 151 and BIOL 152). These courses are the most impacted as they also serve as General Education courses. Additionally, BIOL 151 and BIOL 251 are required by Biochemistry majors and are taken by students in other majors pursuing post-graduate programs in health professions.

While we implemented the requirement for BIOL 325 for all Biology majors at the start of our PPR review period, recent faculty discussions assessing the outcomes of this new requirement highlighted issues arising from the staffing demands of the course. It was noted that BIOL 325 served students well in some EEB and MB concentrations better when it was taken at the start of the upper division. Still, for other concentrations, the course was frequently taken in the final semester, so courses integrate concepts of evolution, providing an alternative. Additionally, concentration changes (below) removed BIOL 325 from the core for some pathways through our program since it does not help students on those paths. These students are still exposed to concepts of evolution valued by our faculty, which are integrated into many biology courses. Removal of BIOL 325 as a required core course will provide more flexibility in the curriculum for students and allow an additional 3 units of upper-division biology electives to be added to each concentration, which may continue to be satisfied by BIOL 325 in concentrations that have always required this course (EEB and MB).

To earn a Bachelor of Science in Biology, students complete 40 units of Biology courses. After completing the shared core of 16 units in lower-division biology, students must complete 23 units of upper-division biology. Most of these units are completed in a concentration consisting of concentration-specific upper-division biology elective (UDBE) courses, including at least 5 units of laboratory- or field-based course work, at least 6 units of 400-level, and at least 2 capstone units. Our program had five Concentrations: [Cell & Developmental Biology](#) (CD), [Ecology & Evolutionary Biology](#) (EEB), [Marine Biology](#) (MB), [Molecular Biology & Biotechnology](#) (MBB), and [Plant Biology](#) (PB). Each concentration has specific course selections and requirements for the 23 upper-division biology units listed in the linked course catalog descriptions. The capstone experience provides “a venue for direct, practical experiences related to the study of biology or the pursuit of a biology career. A capstone course emphasizes the application of student skills in biology through research, field, internship, or service-learning projects that reflect the paradigms of the discipline, i.e., problem-solving and scientific

communication.” BIOL 495, Biological Internship, BIOL 498, Senior Thesis, BIOL 499L, Independent Laboratory Study, as well as specific 400-level courses in each concentration, meet the capstone requirement.

The largest concentrations of C&D and MBB have some courses that overlap. However, they have somewhat different paths for the required 300-level courses. The biological fields pertaining to the C&D and MBB concentration were historically distinct disciplines, but these fields have converged with scientific advances in recent decades, creating more overlap. These concentrations also face unique challenges in providing students sufficient upper-division biology units in their respective concentrations, particularly for upper-division lab units, due to the large numbers of students choosing C&D as the most streamlined pathway toward post-graduate programs in health professions. In light of these considerations, our department has decided to merge these concentrations into a single new Concentration: Cell and Molecular Biology, which is currently undergoing campus review through our Curriculog system. In addition to our specialized concentrations, our department also approved the creation of a General Biology pathway that would allow students to explore more diverse topics while meeting the requisite number of upper-division Biology courses for various requirements (lab units, 400-level) for a degree allowing breadth rather than focusing on depth. Faculty felt that a General Biology option might serve some students with diverse interests in Biology well while also providing a way to improve graduation rates with a more flexible pathway than the discipline-specific concentrations. The merged Cell and Molecular Biology and the new General Biology concentrations are currently undergoing campus review.

In the last PPR, the department stated plans to add a physiology requirement for all students due to the loss of some physiology content when our lower division had been reformed in creating the current core courses, and consensus that student knowledge in physiology was insufficient. A physiology requirement has been added as an “overlay” by identifying several courses within the different concentrations that can meet this requirement while also contributing toward the concentration required units. This program revision has been implemented without increasing student demands to fulfill graduation requirements.

As is typical of undergraduate biology programs throughout the nation, CSUF Biological Science majors must also complete 34 units of supporting mathematics and science courses: one year of general chemistry with lab (CHEM 120A and 120B, 10 units), one year of organic chemistry with lab (CHEM 301A, 301B, and 306A, 8 units), one year of physics with lab (PHYS 211, 211L, 212, and 212L, 8 units), and two semesters of calculus (Math 150A and 150B, 8 units) or one semester of calculus and one semester of upper-division statistics and experimental design (Math 130 and 338, 8 units).

A new addition to the undergraduate Biology curriculum is a 3-unit online asynchronous course BIOL 398 (Scientific Communication Workshop), which originated as a 1-unit course that supported scholars in the National Institutes of Health-supported MARC U-Star program under director Amybeth Cohen. Dr. Cohen secured funding from a supplement to the MARC grant that supported the development of BIOL 398 as a 3-unit intensive writing course. BIOL 398 allows students to fulfill the Upper Division Writing Requirement at CSUF with a course that counts as free electives toward the Biology major as an alternative to the English classes that satisfy this requirement in the Biology program, potentially streamlining the path of our students to graduation.

BIOL 398: *Scientific Communication Workshop*. Instruction and practice in written and oral scientific communication, including retrieval, citation, and evaluation of relevant literature. (Asynchronous Instruction, 3 units)

The department has also participated in college-level initiatives to increase student success. The course CNSM 101 (Think Like Einstein) was developed collaboratively by faculty from Biological Science, Geological Science, Chemistry & Biochemistry, Mathematics, and Physics and offered in Fall 2018. CNSM 101 was designed to support students in their first semester, aiming to increase retention of students in the college through instruction in critical thinking and scientific reasoning and cultivation of a STEM community. A three-year, \$962,361 National Science Foundation grant awarded in 2020 and directed by former Chair of the Department of Biological Science, Dr. Merri Lynn Casem, served to expand this introductory course and further develop a novel lower-division curriculum, including the creation of a complementing summer STEM academy for additional community building that can foster a sense of belonging in STEM that leads to better retention and student success.

CNSM 101: *Think Like Einstein*. Science influences everyday lives. To think like a scientist (and an informed citizen), students need critical thinking, argumentation, and logical reasoning skills. The course develops these skills and provides practice in applying them to various topics. This course is intended for first-time freshmen. (2.5 hours lecture, 3 units)

The department places a substantial value on integrating teaching and research with one-on-one mentoring opportunities in the research courses BIOL 299L (Directed Laboratory Study) and BIOL 499L. Our faculty continues expanding the reach of the original research projects pursued in research laboratories through labs associated with courses by incorporating experiments that deliver authentic research experiences to Biology majors. These experiential learning opportunities expand the reach of faculty research labs and contribute toward the upper division lab units in the concentrations in courses formally recognized as [CUREs \(Course-Related Undergraduate Research Experiences\)](#). A major roadblock for some Biology majors completing all requirements for graduation has been the availability of upper-division lab units. Faculty teaching demands and space limitations preclude offering additional upper-division lab courses or lab sections within courses to address this need. This issue has impacted a small number of students who had completed a sufficient number of Biology units but had a deficit of one lab unit. The department approved waiving the unit, and students were able to graduate with a Titan Degree Audit Exception from the Department Chair. With the large cohorts of students moving through the program now, lab unit completion will become more challenging in the coming years, so the department approved reducing our program's upper division laboratory unit requirement from 6 units to 5 units.

Additional changes to upper division courses include the introduction of new ones with authentic research experiences, such as BIOL 410 (Evolutionary Genetics), BIOL 431 (Advanced Microbiology Lab), BIOL 438 (Public Health Microbiology), BIOL 448 (Plant Molecular Biology), which contribute to our majors' ability to satisfy their upper division laboratory requirements.

BIOL 410: *Evolutionary Genetics*. Introduction to molecular genetic data analysis as commonly applied in Ecology and Evolutionary Biology. Classical population genetics through to the genomics era, focusing on conservation. (2 hours lecture; 6 hours laboratory, 4 units)

BIOL 431: *Advanced Microbiology Lab*. Provide knowledge and laboratory expertise to analyze scientific literature in microbiology, perform advanced microbiological techniques, and conduct independent microbiology research. (1 hour lecture; 6 hours laboratory, 3 units)

BIOL 438: *Public Health Microbiology*. Control and epidemiology of infectious diseases of public health importance, water and sewage microbiology. Control of current problems. (2 hours lecture; 6 hours laboratory, 4 units)

BIOL 448: *Plant Molecular Biology*. Genetic mechanisms in vascular plants controlling metabolism, growth, development, and responses to biotic/abiotic environmental stresses. Molecular regulation of gene expression and transduction of internal and external signals. (2 hours lecture; 6 hours laboratory, 4 units)

BIOL 462: *General Parasitology*. Survey of various animal parasites emphasizing the morphology, physiology, and genetics of human protozoans and helminths. Vectors and common parasites of domestic animals. (2 hours lecture; 6 hours laboratory, 4 units)

In addition to the new experiential learning opportunities developed and offered to our students with laboratory components at CSUF, our students were also offered the chance to have a highly impactful international research experience through the development of BIOL 490T (Biology Study Abroad).

BIOL 490T: *Biology Study Abroad*. Advanced topics in biology for graduate and undergraduate students. Includes laboratory experience; topics may vary. Only offered as part of CSUF Study Abroad Programs. May be repeated once for credit. (2 hours lecture; 6 hours laboratory, 4 units)

A major unplanned circumstance during the PPR review period was the sudden campus closure and shift to virtual learning precipitated by the SARS-2-CoV pandemic. While this abrupt pivot in teaching modalities was an unprecedented short-term challenge universally in education, it also created long-term opportunities for our program. Several courses now have online versions that were intentionally developed using best practices for online learning and have been approved for online

synchronous and/or asynchronous delivery. Courses in the Biology major that may be scheduled for instruction online include the bottleneck course BIOL 151. Development of an online offering has provided the department with a means of accommodating more students in a first-year Biology course and addressing this first-year bottleneck. While in-person laboratory experiences are a priority in our department for our majors, allowing students who are not Biology majors to enroll in an online section of this GE course, which includes a virtual laboratory, serves to overcome the limitation of the number of possible lab sections due to space constraints.

A substantial change to our curriculum to facilitate student access to upper division lab units was undertaken during the review period to separate the lecture and lab units for the highly demanded 5-unit BIOL 302 (General Microbiology) course. As of the academic year 2023-2024, BIOL 302 is now being taught with the two lab units separated into an independent course (BIOL 302L). This separation of lecture and lab is expected to reduce waitlists that impact student progression through the biology upper division.

BIOL 302: *Microbiology*. Introduction to structure and function of bacteria and viruses, including beneficial and detrimental activities and interactions with other organisms. (3 hours lecture)

BIOL 302L: *Microbiology Lab*. Laboratory investigation and skill development with microscopy, aseptic technique, cell culture, physiology, and genetics of microbes. (6 hours laboratory, 2 units)

A final change to our department curriculum during the PPR period was the establishment of the inclusive Pipeline for Research and Other Stem Cell-Based Professions in Regenerative Medicine (iPROSPR) program that offers career and professional development sessions, biotechnology/industry seminars, and hands-on biotechnology workshops held in-person at CSU Fullerton or via Zoom. iPROSPR provides students an opportunity to build their resume, network with others, gain hands-on experience, and cultivate skills outside classroom learning that will promote student success in careers after graduation.

Graduate Programs

A. Curricular changes to existing programs and new programs developed since the last program review. Discontinued programs.

B. Structure of the degree program.

Master of Science in Biology

Although the structure and core components of the MS in Biology Program have remained the same since the previous review, we have made significant improvements to the administration of the program. This was facilitated, in part, by delegating program administrative duties to a single faculty member who was appointed as Biology Graduate Program Adviser. The Program Adviser works closely with the Academic Administrative Coordinator and other staff members to oversee the review of graduate applications, make final admission decisions, provide orientation and training to new students, mentor faculty on graduate student issues, track student progress through the program, and afterward, allocate resources for research, mediate conflicts between students and their faculty mentors, and represent the department in interactions with the administration. Over the review period, we have moved to electronic evaluations of applications, significantly revised the Graduate Student Handbook and program website (<http://www.fullerton.edu/biology/grads/>) to attract applicants, developed a poster that can be used as a recruitment tool, organized and delivered day-long orientation sessions for incoming students, and implemented a formal graduate student advising process to help both students and faculty navigate through coursework and thesis committee meeting requirements in a timely and efficient manner.

Analysis of the Graduate Program with respect to UPS documents.

Review/adoption of department structures for graduate committees and departmental graduate advisors (UPS 270.102). We found our program to be in compliance. Our graduate program committee (the Graduate Advancement Committee) has six qualified members, including the Biology Graduate Program Adviser, who administers the program in coordination with the Academic Administrative Coordinator. Each student has a supervisory committee of at least three faculty members

called the Thesis Committee. This ensures compliance with our department's practices and rules as defined in the Graduate Student Handbook and the UPS 270.102.

Review/adoption of standards for faculty qualifications to teach 500-level courses (UPS 270.103). Our program meets the requirements of UPS 270.103 regarding staffing of 500-level graduate courses—all 500-level courses are taught by tenured or tenure-track faculty with PhD or equivalent degrees.

Review requirements for the “culminating experience” (UPS 330.163). The culminating experience for our graduate students is the writing and oral defense of a thesis and a public presentation of the thesis research results. This experience is further defined in the Graduate Student Handbook. The defense is the opportunity for the graduate student to present their data and place them in the context of the existing literature, demonstrating mastery of the larger body of knowledge associated with the thesis topic. The public presentation demonstrates the graduate student's ability to communicate orally and coherently answer questions posed by those inside and outside their area of expertise.

Graduate writing requirement (UPS 320.020). All MS students complete BIOL500A and BIOL500B in their first year of the program. In these professional development courses, students complete multiple writing assignments, including development of the scholarly thesis research proposal, and they receive and address feedback from both the course instructor and their faculty thesis advisers.

Additionally, graduate students must submit a written thesis reporting their research outcomes. This document also fulfills the requirements established in the Graduate Student Handbook and the UPS. Students who successfully complete the MS in Biology are prepared for careers in teaching, the health professions, government agencies, environmental consulting firms, or private industries, or to enter PhD programs or professional programs in biology-related fields.

Master of Science in Biotechnology

Our department was participating in a multi-campus professional master's degree program for a Masters of Biotechnology at the time of the previous PPR (academic year 2016-2017), which had no actively enrolled students. We discontinued this program during the 2017-2018 academic year, as stated in our previous PPR.

C. Student demand for the department's offerings.

First-Time Freshmen: The number of first-time freshmen applications has trended toward increasing overall, with a drop during the two academic years in which the pandemic impacted enrollment. From the first year of this PPR review period, the number of students admitted to our program has doubled from 2302 in Fall 2017 to 4685 in Fall 2023. The number of students accepting admission offers and enrolling in our program has shown a similar trend, with 363 students enrolled in Fall 2017 climbing to 516 in Fall 2023. (See Appendix A Table 1)

Data from our Office of Institutional Effectiveness and Planning is available for students beginning as first-time freshmen from 2014 until 2020 (See Appendix A Table 3A). Our department's concerted efforts to improve graduation rates are visible in this data, with a noticeable dip for cohorts entering in Fall 2017 who were impacted by the pandemic in their fourth year at CSUF. However, overall, there is a trend of improved four-year graduation rates, rising from the 2013 cohort's 16.9 4-year rate to an average of 27% for the last two cohorts for which data is available. This improvement reflects our department's curriculum changes to remove barriers like bottlenecks in the lower division core. Six-year graduation rates show a dip for students in the 2016 and 2017 cohorts, which might be due to the pandemic impacting their ability to take necessary courses, as anecdotal evidence suggests that some students were opting to wait for upper-division courses with labs for our return to in-person instruction, and this is borne out by the return to a similar 6-year graduation rate for the last cohort with available data (Fall 2018).

Upper Division Transfers: The number of transfer student applications increased steadily and declined in the last two years with available data, but the number of students admitted has risen steadily each year (See Appendix A Table 1B). Likewise, the number of transfer students enrolled in our program has increased from 43 students in the Fall 2017 cohort to 75 in Fall 2023, mirroring the increased enrollment of first-time freshmen. Graduation rates of transfer students are shown in Appendix A Table 3B. Two-year graduation rates for transfer students showed the same dip for students enrolling in Fall

2020, who were impacted by the pandemic and the pivot to virtual instruction, and this rate has similarly recovered for students in the Fall 2022 cohort. Despite the pandemic impact, our 4-year graduation rates for transfer students have remained higher than for the first year of this review period, beginning at 56.3% for students enrolled starting Fall 2016, rising to 72.3%, but again dipping in our final year of data to 61.1%. The department has been overall successful in increasing four-, five- and six-year graduation rates from the beginning of the PPR review period despite the enormous and unforeseen challenge of the pandemic, owing to our continual self-assessment and work at curriculum revision to increase our capacity to serve students in our core biology courses.

Graduate Students: Data on graduate applications, admission, and enrollment is shown in Appendix B Table 5. The average number of applications per year in the reporting period is 40, showing a 20% decrease from the previous reporting period (average 50 applications/year). The admission percentage in 2023 was 60.5%, and the percentage of admitted students who matriculated was 87%. Four-year graduation rates for our graduate students have averaged 52.05% and are quite variable over the period of review but showed a significant increase compared to the four-year graduation average of the previous reporting period (43.9%). A considerable increase in the graduation time was observed for students admitted in 2019-2021 due to the restrictions imposed by the COVID-19 pandemic. Two-year graduation rates have averaged 5.9% and are also quite variable over the period of review. Detailed data are available in Appendix B Table 7A.

D. Enrollment trends since the last program review

Tracking along with our strong growth in the number of majors, FTES for Biology majors showed a trend of increasing during the PPR review period, with a dip and recovery reflecting the impact of the pandemic on enrolment numbers. The number of undergraduate majors and graduate students increased from a headcount of 1291.5 in AY 17-18 to 1486.5 in AY 23-24, with FTES overall increasing from 1104.00 in AY 17-18 to 1305.23 for AY 23-24. In general, FTES per student headcount values have remained relatively steady, at 0.87 - 0.89, after increasing from 0.85 in the initial year of the review period. (See Appendix A Table 2B)

Data on the graduate program can be seen in Appendix B Table 6. Our graduate program has averaged an annualized headcount of 54.6 students. Despite difficulties in recruiting, we have maintained an enrollment of around 50 graduate students in the program. This is sufficient enrollment to maintain a vigorous community of scholars in the program. We would like to grow the program to at least 75 (two to three students per advisor) students, but we are limited by the number of faculty advisors and the available resources to support students.

E. Plans for curricular changes in the short (three-year) and long (seven-year) term.

As our program has grown due to increased campus enrollment, we have responded to the large influx of students with changes in the Biology core. Still, we must plan for the large number of students progressing through our upper division, which has several issues to address. Our plans for changes to the program are as follows.

- 1) The new Cell and Molecular Biology concentration, merging our two largest concentrations, will launch with existing courses in Fall 2025. Faculty in the concentration will merge the courses BIOL 303 (Intermediate Cell Biology) and BIOL 309 (Intermediate Molecular Biology) to create a common 300-level course that can serve as a prerequisite to 400-level courses that currently require either BIOL 303 or BIOL 309. This would streamline progression through the new concentration and facilitate student enrollment in the 400-level courses they may need to graduate, particularly to satisfy upper-division lab unit requirements.
- 2) Many faculty members in the department feel that our program needs a review of common learning outcomes, the elective courses that students take toward learning outcomes, and our use of Biology core versus 300-level courses as prerequisites for 400-level courses, which vary across concentrations. The major needs consistency across concentrations
- 3) The faculty has noted measurable declines in student engagement and success in our courses since the pandemic but persisting through the current academic year. A priority will be to consider how student success can be supported without lowering department standards for education quality.
- 4) The six-lab unit upper division requirement will be reduced to five in a program change to facilitate completion of our program requirements.

During the PPR review period, new General Education offerings were developed. BIOL 103 (Biology of Disease) is a new GE Area B2 – Life Sciences course that meets the category learning objectives from a perspective that may be more attractive and engaging to students.

The Masters of Biotechnology Program was discontinued during the 2017-2018 academic year.

F. Special Sessions self-support programs offered by the department.

The Department of Biological Science does not offer any programs in Special Session self-support mode.

III. Documentation of Student Academic Achievement and Assessment of Student Learning Outcomes

A. Department's assessment plan.

Our departmental assessment program is administered by our assessment committee chaired by a faculty member who coordinates our efforts with the broader university assessment process. Since the last PPR, assessment efforts are best described in three phases that reflect both significant changes within our department, and broader changes due to the COVID-19 pandemic:

2017-2018: Continued implementation of the assessment program as described in the prior PPR. Efforts centered on the annual university assessment process of our departmental student learning objectives (SLOs) at both the undergraduate and graduate levels.

2019-2023: The assessment program was significantly impacted by personnel shifts in our department, including both department chair and assessment committee chair changes, in combination with the effects of the sudden shift to online instruction with the COVID-19 pandemic. During this period, limited assessment was performed.

2023-Present: We have begun to restructure our assessment program to better fit our department needs, and to more effectively use the assessment committee to implement the program, instead of relying primarily on the committee chair.

The specific efforts during these periods are described in sections B-E.

Classroom Assessments: All courses at both the undergraduate and graduate level incorporate a variety of formative and summative assessment tools into their curriculum to evaluate student learning. Assessment instruments vary depending on the specific course content, modality, and goals, but include iClicker questions, in-class and online discussions, group work, writing assignments both in-class and at home, laboratory reports, field journals, metacognitive reflections, quizzes, and exams.

Assessment of the graduate program: Progress toward the Graduate SLOs is annually measured by indirect and direct methods. Indirect assessment is achieved by voluntary surveys administered to students enrolled in the MS program and their faculty mentors. Faculty mentors are asked to report students' conference presentations and publications. Student sentiment and evaluation of the MS program is assessed via anonymous surveys. Direct assessment is done by tracking student progress through academic advising conducted every semester by faculty mentors, and reviewed by the Graduate Adviser, as well as documentation of required milestones (first and second committee meeting, thesis defense) as indicated in the Graduate Student Handbook.

B. Student learning outcomes (SLOs).

As part of the university assessment process, our department submits annual reports on the state of our assessment of our department student learning outcomes (SLOs), performance outcomes (POs), and graduate student learning outcomes (MS_SLOs). The tables below were compiled from reports submitted for 2017-2024.

Undergraduate SLO Assessment 2024

Biological Science SLOs and POs	Criteria for Success	Current State of Assessment
I. (SLO) Explain fundamental biological principles from the major areas of biology (cellular, molecular, physiology, organismal, ecology, and evolution)	1) Significant increase in concept inventory scores from pre- to post-testing within relevant courses. 2) Significant increase in concept inventory scores in upper-division courses than in introductory courses.	Upper division evolution understanding assessed and not met in spring 2024
II.(SLO) Design a research study to answer a testable question, using appropriate and ethical procedures for data collection and analysis.	1) Significant increase in TOSLS scores from introductory to upper division courses. 2) 70% on Experimental Design Test after instruction in introductory course.	Assessed and not met in 2022
III.(SLO) Communicate ideas related to biological concepts, or the results of biological investigations, using professionally appropriate oral (e.g., poster/oral presentations), visual (e.g., graphs/tables), and written (e.g., grant proposal/journal article) formats.	1) Upper division students average 70% on presentation rubric. 2) Student self-report improvement in writing, oral, and visual presentations.	Assessed and not met in 2022
IV.(PO) Engage in projects that require contributions of multiple individuals, resulting in a product that reflects the ability to collaborate and communicate.	1) A minimum of 75 % of introductory, gateway, and capstone courses include a collaborative assignment that meets Performance Objective. 2) Student self-report improvement in ability to work collaboratively.	Assessed and met in Biol 151 & 152 in 2018-2019
V.(SLO) Demonstrate intellectual independence by distinguishing between reliable and unreliable sources of information while respective alternative possibilities and explanations.	1) Significant increase in TOSLS scores from introductory biology to capstone course.	Not yet assessed.
VI.(SLO) Discuss the impact of biological issues on society, the importance of responsible conduct of research, and the role of society in supporting scientific endeavors.	1) Positive evaluation by students of BIOL support for stewardship. 2) Evidence of participation in stewardship activities (self-report).	Assessed and met in Biol 151 & 152 in 2018-2019

SLO #1

The results of our spring 2024 survey using the Genetic Drift Inventory (GeDI) of students at the end of Biol 325 (Evolution) produced some disappointing results, but provided some guidance regarding how to better incorporate evolution content into our curriculum. In 2016, we used this instrument to evaluate pre- and post-course understanding in Biol 152. Students demonstrated significantly improved understanding over the course of Biol 152. In contrast, the GeDI was only administered at the end of Biol 325 to capture student understanding at the conclusion of the course intended to develop their mastery of evolutionary concepts. Results were not significantly different than at the end of Biol 152. The most significant finding was that there was a definite improvement in understanding based on length of time in our program, with a clear progression from sophomore standing to graduating senior status.

SLO #2

We administered the BIOL Research Experience and Interest Survey in March 2022 to early career biology major students. Unfortunately, we had very poor response rates (only 6 completed surveys). Although the low sample size precludes the use of the data for planning purposes, the survey has potential as a tool to gather student perspectives on their training in research skills. Of the 6 who reported, all but one were first year students enrolled in introductory courses (one did not report). All stated that they had at least some training in the research skills we listed.

SLO #3

As with SLO#2, we administered the BIOL Research Experience and Interest Survey in March 2022, but had poor response rates that made use of the results extremely limited. Student responses did suggest that the instruction in graph and table construction was more apparent than was instruction in oral and written communications of science. While this could be related to changes made during the pandemic, it could also suggest that we could be more explicit in our instruction around communication. More data in future administrations of this survey will be helpful.

SLO #4

We used a locally developed survey to assess students' perceptions and experiences of their teamwork opportunities and abilities in biology courses. Students took the test at the beginning and end of the semester in BIOL 151 and BIOL 152. These data, coupled with results from the previous year, establish a baseline for future comparisons with results from upper-division courses. Overall, students rated their ability to participate in teams as quite high, but we did see gains across the semester. Preference for working in teams was relatively lower and did not change over the semester. We also asked students to describe their experiences with teamwork during their biology courses. Students reported an increase in the number of opportunities to participate in teamwork during their biology courses and to serve as a leader. Encouragingly, students also viewed the biology courses as having improved their preparation for team leadership in their fields. Taken as a whole, these data provide evidence that students are participating in, and benefiting from, teamwork activities at the introductory level.

SLO #5

Since we have not yet assessed this SLO as part of the university assessment process, developing detailed plans for assessing this SLO is a priority for the department assessment committee as we work to re-activate our undergraduate assessment program.

SLO #6

We assessed this SLO in tandem with PLO#4 in BIOL 151 & 152. Overall, students rated their perceptions high for all elements of our stewardship survey. Furthermore, perceptions of 4 elements increased over the semester for introductory biology students (The importance of research on establishing public policy and environmental stewardship, the role of biology in society and the role society plays on shaping biology research). However, student perceptions of their appreciation for the importance of research on human health and responsible conduct of research appear to have decreased over the semester. Based on these results, we have largely met our assessment target, in that average scores are overwhelmingly positive. However, the decreases in two elements suggest that we could revisit our treatment of some topics in introductory courses.

Graduate SLO Assessment 2023

MS Biology Program Student Learning Outcomes (MS_SLOs)	Criteria for Success	Current State of Assessment
I) Demonstrate expertise in a biological discipline through critical evaluation of primary literature and knowledge of appropriate research approaches and techniques.	1) Majority (>50%) of MS students increase their ability to critically evaluate primary literature and apply the knowledge to their field of research. 2) Majority (>50%) of MS students present research proposal at 1st committee meeting within two years of starting the MS program (rubric; expertise in field,)	Assessed by Graduate Adviser and Graduate Advancement Committee from 2017 to 2022
II) Demonstrate expertise in a biological discipline through the design, execution, analysis, and interpretation of an independent ethical research project.	1) Majority (>50%) of MS students present research progress at 2 nd committee meeting within 3 years of starting MS program (rubric; experimental design, data collection) 2) Majority (>50%) of MS students defend thesis within 5 years of starting the MS program (rubric; data analysis, interpretation)	Assessed by Graduate Adviser and Graduate Advancement Committee from 2017 to 2022
III) Communicate the results and conclusions of an independent research project orally and in writing to appropriate professional audiences.	1) Majority (>50%) of MS students present (i.e., poster, oral) at least one professional conference within 3 years of starting the MS program. 2) At least 30% of MS students are listed as an author on a submission of a manuscript within 5 years of starting the MS program.	Assessed by Graduate Adviser and Graduate Advancement Committee from 2017 to 2022.

MS-SLO I

The Graduate Committee, led by Dr. Paul Stapp, tracked MS student progress and surveyed development of critical thinking and literature analysis. Results indicated that:

- 1) At least 70% of students who are in year 2 or 3 of the program indicate that their ability to critically evaluate primary literature and evaluate different research techniques has increased since the previous year.
- 2) 86% of students pass their First Committee Meeting within two years of starting the MS program.

MS-SLO II

Indirect and direct assessment indicate that:

- 1) 70% of all students who are in year 2 or 3 of the program indicate that their ability to select an appropriate research design for a research question and to consider the ethical implications of their own research design, approach, and outcomes has increased since the previous year.
- 2) A majority of students (71%) pass their Second Committee Meeting within 6-6.5 semesters (3-3.5 years).
- 3) The majority (83%) of MS students defend their thesis in under five years; 54 % finish in under four years, and about one quarter (23%) finish in three or fewer years.

MS-SLO III

We found the following levels of participation:

- 65 % of MS students have participated (poster or oral presentation) in a national or international conference while 83% of MS students have participated in any conference (CSU/regional or National/International)
- 54% of MS students are listed as authors in a peer-reviewed publication.

Our data shows that we have exceeded all the criteria for success established for the reporting period. These encouraging results motivate us to continue moving the goal up. We plan to meet as a department to review our MS-SLOs and discuss if our criteria for success are appropriate for our current student population and goals of the department faculty for the graduate program.

C. Assessment results and how they have been used to improve teaching and learning practices, inform faculty professional development, and/or overall departmental effectiveness.

Undergraduate Program: Our department has been exploring options for integrating evolution content into the curriculum as a way to remove the requirement for all majors to take Biol 325. Since Biol 325 has become a roadblock for many students, the results of our spring 2024 GeDI survey give the department data to help inform decisions regarding evolution content.

MS Biology graduate Survey 2023: In conjunction with the Graduate Studies office, in Spring 2023 the former Biology Graduate Adviser Dr. Paul Stapp designed and implemented an anonymous survey that aimed to collect information regarding graduate student satisfaction and areas that need improvement. As a result, we have identified the following needs: 1) Increase the financial support and research resources for graduate students 2) Improve the understanding of program requirements, goals and timelines for both graduate students and faculty mentors 3) Increase the resources to support mental health and well-being of graduate students 4) Improve communication of graduate students with staff, program adviser and faculty mentors.

The survey provided valuable information to plan for specific interventions on each area that will be discussed with the Graduate Advancement Committee and the department. We plan to continue administering this survey annually and include new questions to assess the effectiveness of the implemented interventions.

D. Other quality indicators identified by the department as evidence of student learning and effectiveness/success other than student learning outcomes.

1) Scientific Communication: One of the department's student learning outcomes (SLO III) focuses on communication of science. All students are required to present research in oral, written, and visual forms in introductory and upper division courses. However, the department also tracks student presentations at conferences and manuscript co-authorship. CSUF biology students regularly attend regional and national conferences, such as the Southern California Academy of Sciences and the Society for the Advancement of Chicano and Native American Students annual meetings. We record the number of students who attend conferences, present research in poster or oral presentations, and win awards for those presentations. CSUF biology students also publish independent and collaborative research in scientific journals. We track the number of undergraduate and graduate authors who publish in scientific journals each year.

2) Independent Research: Students regularly apply for departmental, university, and external grants, scholarships, and research programs. Successful applications demonstrate the department's success in supporting student learning in biology, particularly SLOs I - IV. The department surveys faculty annually to monitor the number of successful student applications.

3) Community Engagement: We value student engagement on campus and in the community (SLO VI). The department records the number of students engaged in on-campus organizations, such as the Biology Club, volunteer activities, and service learning opportunities. Students that register with the Center for Internships and Community Engagement track their volunteer hours with off-campus partners; the department has access to those data as well.

E. Courses and programs offered via technology (e.g., online).

The online courses offered by our department have expanded since the prior PPR. Where online courses were once limited to general education, non-majors courses, we now offer multiple majors courses in an online modality. We do not currently have a formal plan for the assessment of these courses outside of the regular assessment of our department SLOs and program objectives (POs). Instructors of online courses have participated in one of the professional development offerings

for online teaching from the Faculty Development Center or CSU Office of the Chancellor, so these courses include course-based assessments tailored to an online modality.

IV. Faculty

A. Describe changes since the last program review in the full-time equivalent faculty (FTEF) allocated to the department or program. (Attached faculty curriculum vitae in Appendix F).

he department's recruitment and search processes during the review period resulted in the hiring of two research-active, student-focused tenure-track faculty members: Dr. Jeffrey Olberding, a physiologist and herpetologist, in 2021, and Dr. Joselyn Soto, a neuroscientist focused on brain biology, in 2024. Recruitment efforts were notably slowed by challenges associated with the COVID-19 pandemic. As of the writing of this report, the department has successfully recruited a candidate for a tenure-track position specializing in terrestrial arthropod biology and ecology.

The department currently comprises 25 tenured faculty members, including two participating in the FERP program, as well as 2 tenure-track faculty and 2 full-time lecturers. Two tenured professors are also occupying administrative positions with retreat rights. Collectively, tenured faculty, tenure-track faculty, and full-time lecturers will be referred to as Full-Time Faculty. These Full-Time Faculty account for 53.7% of the Full-Time Equivalent Faculty (FTEF), the lowest percentage recorded during the review period. Furthermore, Full-Time Faculty represented 69% of FTEF at the end of the previous review. Table 1 provides a detailed breakdown of FTEF numbers and percentages across the instructors' categories.

Table 1. FTEF Distribution (2017–2024)

Fall	Full-Time Instructional Faculty (PPR)				Part-Time Faculty FTEF		Total FTEF	% Full-Time Faculty FTEF
	Tenured	Tenure-Track	Full-Time Lecturers	Full-Time FTEF	Part-Time Lecturers	Teaching Associates		
2017	19.0	8.0	6.0	33.0	8.4	11.5	52.9	62.4%
2018	20.0	7.0	4.0	31.0	11.4	10.1	52.5	59.0%
2019	22.0	4.0	3.0	29.0	11.9	11.2	52.1	55.7%
2020	23.0	3.0	3.0	29.0	11.4	7.7	48.1	60.3%
2021	26.0	1.0	5.0	32.0	9.8	8.7	50.5	63.4%
2022	26.0	1.0	4.0	31.0	13.2	9.2	53.4	58.1%
2023	24.0	1.0	8.0	33.0	15.1	5.9	54.0	61.1%
2024	23.5	2.3	4.0	29.8	18.1	7.6	55.5	53.7%

The number of undergraduate majors increased from 1,291.5 in 2017-2018 to 1,486.5 in 2023-2024, reflecting a 15.1% growth (Table 2), and it has increased in the current year. Similarly, the number of graduate students rose from 50 to 59 during the same period, an 18% increase (Table 2). Full-Time Equivalent Students (FTES) grew by 18.2%, from 1,130.42 to 1,335.81. This growth highlights the department's success in managing the rising student population alongside FTES. In the previous PPR, we noted that there was an increase of 9% in FTES, while the headcount increased by 44%. This discrepancy, significant growth in headcount but not in FTES, was mainly the consequence of curriculum changes that included a reduction in units in the lower-division core classes, a change necessary to reduce bottlenecks. The discrepancy has been corrected in the current review period, during which the increase in FTES and headcounts are comparable. *On the other hand, it is notable that while student headcount and FTES increased by nearly 20%, the number of full-time FTEF has declined* (see Table 1).

Table 2. Headcounts, FTES, and FTES per Headcount (2017–2024)

Academic Year (Annualized)	Undergraduate Program			Graduate Program		
	Headcount	FTES ¹	FTES per Headcount	Headcount	FTES	FTES per Headcount
2017-2018	1291.5	1104.00	0.85	50.5	26.42	0.52
2018-2019	1260.5	1101.50	0.87	52.5	27.92	0.53
2019-2020	1345.5	1193.93	0.89	53.5	26.92	0.50
2020-2021	1484	1325.33	0.89	57	30.08	0.53
2021-2022	1433.5	1254.40	0.88	52	27.54	0.53
2022-2023	1358	1178.47	0.87	54.5	26.38	0.48
2023-2024	1486.5	1305.23	0.88	59	30.58	0.52

¹FTES of all students who are majoring in the program.

B. Describe priorities for additional faculty hires.

We currently fill almost 54% of our FTEF with Full-Time Faculty, and our FTES is growing. While we need more tenured/tenure-track faculty to provide students faculty-mentored research experiences and increased access to other high-impact practices, to advise majors, mentor student clubs, design curriculum and develop new programs, conduct assessments, and seek external funding, we cannot hire more faculty unless we receive additional space and funds to reconfigure and renovate current space for faculty offices and research laboratories, adequate start-up equipment funds, funds to maintain current shared research facilities and a CSUF-wide commitment to a strong and sustainable research culture. At the moment this report is being written, we are in the process of filling a Terrestrial Arthropod Biology/Ecology scientist position. On the other hand, two plant biologists have recently joined the Faculty Early Retirement Program (FERP).

Based on our curriculum and student interest, the areas of need are cell and molecular biology and plant biology (due to the two faculty that just joined the FERP program). These faculty are needed to teach in our introductory core course sequence and upper division required courses.

C. Describe the role of tenure line faculty, lecturers, and graduate/student assistants in the program/department's curriculum and academic offerings.

The Full-Time Faculty are involved in teaching majors and non-majors courses (General Education Courses and Service Courses). Examples of General Education and Service courses are *Elements of Biology*, lecture and lab, *Biology for Future Teachers*, *Biology of Disease*, *Environmental Biology and Sustainability*, *Microbiology for Nursing and Allied Health Professionals*, and *Human Anatomy and Physiology*.

Tenured and tenure-track faculty mentor graduate and undergraduate students in their research laboratories and teach graduate courses. They are also heavily involved in teaching courses within the major and the graduate program compared to lecturers. Part-time lecturers primarily teach lower- and upper-division courses in the major, as well as General Education and service courses.

Dr. Carol Chaffee, a full-time lecturer, is the Coordinator for *Elements of Biology* (BIOL 101) and works closely with lecturers and tenure-track faculty who teach non-major courses. Similarly, Dr. Megan Tommerup, another full-time lecturer, coordinates *Biology for Future Teachers* (BIOL 102) and *Life Science Concepts* (BIOL 453), both designed for prospective elementary school teachers.

A position for a Director of the Non-Majors Biology Program was originally planned to oversee General Education and service courses but was never filled. Dr. Chaffee has taken on many of its responsibilities in its absence, **highlighting an ongoing departmental need**. A potential candidate for this position should also have expertise in implementing General Education courses online.

Additionally, there is a need for a **full-time lecturer** to coordinate the more than 20 lab sections of *Cellular and Molecular Biology* (BIOL 151) and manage the newly created General Biology concentration, ensuring proper support for these critical programs.

Teaching Associates (TAs) and Instructional Student Assistants (ISAs) are graduate students in the Masters program. They teach laboratory sections in both lower- and upper-division courses for majors and non-majors. All TAs are required to take BIOL 500C, *Professional Aspects of Teaching*. This course focuses on understanding, improving, and evaluating how biology is taught and learned at the college or university level. Exploring topics related to biology education research, pedagogy, instructional design and assessment, graduate students prepare for biology laboratory and classroom instruction. The training includes various teaching techniques and specific assignments designed to help TAs apply the material learned in their own courses. Faculty members serve as laboratory coordinators and, together with permanent staff, work closely with TAs to plan each lab session and oversee the assessment of student work.

While TAs play a critical role in teaching laboratory sections for both majors and non-majors, the department currently faces a shortage of graduate students interested in those positions. This shortage places additional strain on our ability to staff laboratory sections, particularly in both lower- and upper-division courses. Without sufficient TAs, the department must increasingly rely on hiring part-time lecturers to fill these instructional needs, which stretches our resources and limits opportunities for graduate students to gain teaching experience and financial support. Increasing the number of graduate TAs would address these staffing challenges and enhance our graduate students' professional development by providing them with valuable teaching and mentoring opportunities. ***Incentives such as increasing compensation or waiving tuition are a few strategies to draw interest and revert the situation described in this paragraph.***

Additionally, the structure of teaching laboratories in courses with multiple sessions can be frustrating for lecturers, as all sections must remain synchronized and follow the same schedule. This setup limits instructional autonomy, which may not be a concern for TAs early in their careers. However, it can be less satisfying for lecturers, many of whom hold PhDs and seek a more engaging teaching experience with greater control over their courses. The lack of flexibility may lead to decreased job satisfaction, discouraging experienced instructors from returning and affecting their enthusiasm for the role. ***These challenges highlight the department's need to increase the number of graduate students in the program to ensure a sustainable pipeline of qualified TAs.***

During the 2023-2024 academic year, full-time faculty generated 54.4% of our FTES, accounted for 52.8% of the total enrollment, and taught 76.3% of course sections. During this same period, part-time lecturers generated 44.0% of our FTES, accounted for 42.6% of the total enrollment, and taught 20.0% of course sections. Teaching associates generated 1.6% of our FTES and accounted for 4.6% of the total enrollment and taught 3.7% of course sections. These data are summarized in Table 3.

Table 3. Distribution of FTES, Enrollment, and Course Sections

Appointment & Course Category	Fall 2023			Spring 2024		
	Sections	Enrolled	FTES	Sections	Enrolled	FTES
Full-Time Faculty						
GE	11	553	100.3	18	747	109.5
GE & Major	1	48	9.6	0	0	0.0
Service	4	76	20.3	0	0	0.0
Service & Major	34	726	191.9	13	300	80
Major	115	1,446	286.5	113	1,486	273.8
Graduate	71	180	22.2	70	191	23.8
Subtotal	236	3,029	630.8	214	2,724	487.1

Appointment & Course Category	Fall 2023			Spring 2024		
	Sections	Enrolled	FTES	Sections	Enrolled	FTES
Part-Time Lecturers						
GE	29	1,581	268.3	23	1,391	252.1
GE & Major	0	0	0.0	0	0	0.0
Service	3	118	27.2	10	218	58.1
Service & Major	10	216	54.2	25	545	139.9
Major	9	284	50.7	9	283	53.3
Graduate	0	0	0.0	0	0	0.0
Subtotal	51	2,199	400.4	67	2,437	503.4
Teaching Associates						
GE	6	143	9.5	7	167	11.1
GE & Major	0	0	0.0	0	0	0.0
Service	0	0	0.0	0	0	0.0
Service & Major	0	0	0.0	0	0	0.0
Major	9	194	12.9	0	0	0.0
Graduate	0	0	0.0	0	0	0.0
Subtotal	15	337	22.5	7	167	11.1
Total	302	5565	1053.7	288	5328	1001.6

D. Include information on instructor participation in Special Sessions self-support programs.

Faculty have the option to participate in Special Sessions self-support programs in the summer and winter sessions (Table 3). Lower and upper-division majors and general education and services courses were offered during the reporting period. The offerings have been usually successful based on feedback from students and faculty.

Table 3. Courses offered in Special Sessions (Summer 17 to Summer 24)

Course Number	Course Title	Sessions
BIOL101	Elements of Biology	W18-24, S17-24
BIOL101L	Elements of Biology Laboratory	S17-19, 22-24, W24-25
BIOL102	Biology for Future Teachers	S17, 18
BIOL151	Cellular and Molecular Biology	S22-24
BIOL151 Lab	Cellular and Molecular Biology Lab	S22-24
BIOL251	Genetics	S19, 24, W23, 24
BIOL252	Principles of Ecology	S20-24

BIOL301	Problems in Environmental Biology	S17, 18, 21
BIOL303	Intermediate Cell Biology	S18, 19, 21, 23, 24
BIOL309	Intermediate Molecular Biology	S17-21, 23, 24
BIOL325	Principles of Evolution	S23
BIOL329	Essential Techniques in Cell Biology	S17-19, 21
BIOL336	GEO/BIO Field Investigations	W19, 20
BIOL411	Medical Genetics and Systems Biology	S17, 18, 20, 21
BIOL414	Microbial Genetics	W18-24
BIOL427	Stem Cell Biology	S20
BIOL428	Biology of Cancer	S19-22, 24
BIOL453	Life Science Concepts	S17-22
BIOL482	Capstone Studies in Biology	W18-20
BIOL490	Clinical Microbiology and Infectious Diseases	W18, 19
BIOL490T	Biology Study Abroad	W20-24
BIOL495	Biological Internship	S17-24

V. **Student Support and Advising**

A. Department advising of its majors, minors, and graduate students.

Advising is available to students for six weeks each semester and during faculty office hours throughout each semester. In the fall semester, advising is mandatory for all majors. In the spring semester, advising is mandatory for specific groups: first-time freshmen, recent transfer students, candidates for summer or fall graduation, and students on academic notice. For all other majors, advising is optional in the spring.

Mandatory advising is enforced with a registration hold, which is released following advising. First-time freshmen and students still completing the initial core biology courses (BIOL 151, 152) participate in group sessions led by the NSM Student Success Team with materials generated by the Undergraduate Advancement Committee. These sessions provide information on the major, guidance on course sequencing, supporting courses, career resources, and encourage students to take individual responsibility for understanding major requirements. These students are also enrolled in a Canvas advising site with relevant information for biology major students.

Sophomores and students completing the final two lower division core biology courses (BIOL 251, 252, and associated labs 253L, 254L) attend group advising sessions led by the Undergraduate Advancement Committee in which they receive advice for declaring a concentration that will serve their future goals. They are also enrolled in a Canvas advising site tailored to their academic stage.

Upper-division students who have completed the biology lower-division courses and are enrolled in 300- and 400-level courses meet individually with a biology faculty adviser. The Undergraduate Advancement Committee also leads drop-in advising sessions in the advising period; unlike the other advising interactions, students do not need to make an appointment for these sessions. Outside the advising period, students can access the Department of Biological Science advising website, which offers resources like FAQs and course planning worksheets. An advising-specific email address is monitored year-round, and NSM Student Success Team advisors are available for meetings throughout the year.

When students apply for graduation, the department initiates a graduation review, which the Undergraduate Advancement Committee and the Student Success Team complete. This review determines if each student meets the requirements for

candidacy and provides a course plan to complete degree requisites on time. During the next advising period, graduation candidates meet with the Student Success Team advisors to follow up with a customized plan to ensure graduation. These students also have access to the drop-in advising with designated members of the Undergraduate Advancement Committee.

Due to increased enrollment, we continue to explore alternative means of providing students access to advising. We have been using our Canvas site to advise and provide feedback on course plans. The drop-in advising sessions have been well-attended and are now a standard part of our process. As described above, the NSM Student Success Team advisors have taken on additional advising tasks, such as meeting with the freshmen and those who have applied for graduation.

Students interested in changing their major to Biological Science or adding a second major meet individually with a faculty advisor to develop an academic plan. Thereafter, they are placed in the appropriate level of advising.

The department has two biology minors: Cell and Molecular Biology and Environmental Biology. Students interested in pursuing a minor meet with the designated faculty minor advisor to develop a plan to integrate their minor coursework with their major course plan. Students have access to advising comparable to that provided to majors throughout their careers.

Under the guidance of the department Graduate Adviser, graduate students create a 30-unit study plan as part of their BIOL 500AB course in consultation with their research thesis mentor and with the approval of their thesis committee. Graduate students meet with their research mentor for formal advising each semester to monitor their progress and stay on track to complete all courses on the study plan.

B. Opportunities for students to participate in departmental honors programs, undergraduate or graduate research, collaborative research with faculty, service learning, and internships.

The Department of Biological Science has only 30 tenured and tenure track faculty serving well over 1600 majors (up from 1200 since our last PPR). Our program already lacked the capacity for all of our students to participate in an intensive research experience under the close guidance of a faculty mentor, which is impossible given our resource and space constraints, and this has been exacerbated by the growth of our enrollments without a concomitant increase in faculty lines. To provide students with opportunities to participate in departmental research at scale, we offer students alternative high-impact learning experiences through our 400 level capstone courses, study abroad/away opportunities, a growing number of our upper division courses integrating the research programs of the faculty instructors as course-based undergraduate research experiences (CUREs), plus opportunities for students to be exposed to research through their course laboratory components pearly in the major. As many of our programs for student engagement in high-impact research experiences are externally funded, some have been discontinued due to the changing directions of funding agencies.

To increase the number of students involved in faculty-mentored research and expose students to research and professional development opportunities earlier, the department has:

- Hired two new student-centered, research-active faculty representing important and integrative subdisciplines, all of whom are mentoring both undergraduate and MS research students.
- Supported the **Research Careers Preparatory (RCP) program**, which addresses the need to expose students to research earlier and provides a more robust pipeline of students prepared for our funded research-training Scholars programs noted below.
- Secured funding to continue the research support from the National Institutes of Health (NIH) formerly for our long-standing **Maximizing Access to Research Careers (MARC)** program through the new **Undergraduate Research Training Initiative for Student Enhancement (U-RISE)** program, which aims to recruit, retain, and prepare promising undergraduate students with various lived-experiences to successfully pursue a career in Biomedical Science research.
- Implemented a new externally funded student research scholars program called **Creating Opportunities through Mentorship and Partnership Across Stem Cell Science (COMPASS) program supported by the California Institute for Regenerative Medicine (CIRM)**.
- Implemented a **Cancer Research Education Program (CREP)** as the educational component of the CSUF/UCI-CFCCC Cancer Health Equity Research Partnership (CHERP) between the years 2021-2026. Funding for the program

is not renewable, and the department plans to apply for new support utilizing the National Institutes of Health R25 mechanism for educational projects.

- Continued previously established programs of: **Bridges to Stem Cell Biology (BSCR) program** supported by the California Institute for Regenerative Medicine (CIRM) and the continuing **Minority Health and Health Disparities Research Training (MHRT)** program.
- Institutionalized student support for the long-running **Southern California Ecosystems Research Program (SCERP)** that was previously supported through a grant from the National Science Foundation (NSF). This program now recruits students through the Summer Undergraduate Research Academy (SUREA) at CSUF, administered through the Undergraduate Research Opportunity Center.
- Made students aware of additional research opportunities outside of CSUF by establishing and sharing with our classes the **CSUF Biology--Jobs and Internships for Students (and alums!)** Google sheet.
- Partnered with student groups, including the **Biology Club, Biology Graduate Student Club** and **Students United with Community Collaborators to Enhance Success in Science (SUCCESS)** to provide leadership, mentoring, and community-building opportunities.

The department also actively participates in the **CSU Biotechnology Program (CSUBIOTECH formerly CSUPERB)**, the **CSU Council on Ocean Affairs, Science and Technology (COAST)**, the **Water Resources and Policy Initiatives (WRPI)**, the **Ocean Studies Institute (OSI)**, and the **California Desert Studies Consortium (CDSC)**, all of which are CSU research and education consortia that offer research opportunities and/or support for undergraduate and graduate students, as well as our faculty.

To support graduate students enrolled in the MS in Biology program, the Graduate Studies Office, with the support of the University President, has provided a limited number of **tuition waivers for incoming or continuing Teaching Assistants**. This support increases our ability to recruit excellent student-teachers who are instrumental in the hands-on laboratory experience of undergraduates. Additionally, with generous donations from former CSUF faculty, we have instituted a **Biology Teaching Associate Thesis Writing Fellowship** to support outstanding students completing and defending their thesis. The Biology graduate students are also eligible for numerous [University and College Scholarships](#). Our MS students can access writing and professional development workshops, social activities, and mental health support through the University [Graduate Studies Center](#).

VI. Resources and Facilities

A. State support and non-state resources the department received during the last seven years. (See Appendix D)

State Support - Salaries

Faculty, Teaching Associate, and Graduate Assistant Salaries are the most significant portion of our spending. Our spending on full-time faculty has increased by 7.14%, as would be expected based on raises and new hires. Our spending associated with teaching associates decreased by 38.74%. Our lecturer costs showed a substantial increase of 74.34%, showing the need for more tenure-track faculty and teaching graduate students. These data are available in Appendix D, Table 10a).

State Support - Operating Expenses (Equipment, Supplies, and Student Assistants)

Our Operating Expense Budget has increased by 61.37% during the period covered by this PPR. We use these funds for our operating expense budget and provide \$1,000 per faculty member to support student research. In the fiscal year 2024-2025, we received an additional one-time sum of \$400,000 to purchase equipment, audio/visuals for instruction, computers and computer accessories, and class materials. We analyzed the purchases carefully in preparation for expected future budget cuts. Equipment and support for classes are annually funded by course-related instructional fees of approximately \$100,000. Additionally, the department provides research support for undergraduate and graduate students enrolled in research units (BIOL 299L, BIOL 499, and BIOL 599) ranging from \$150-\$500 per student, depending on the status and progress of their research.

External Funding

There was a significant variation year to year in the number of dollars obtained from external funding agencies, possibly because some awards are paid in a single installment despite covering multiple years (Table 10b). The total amount the faculty awarded from external funding sources since the last PPR is \$22,693,841. The number in the previous PPR period was \$22,697,942.

We currently have \$2,056,336.15 in several philanthropic and endowment accounts. Most of the accounts are designated for scholarships, but others are designated for travel, maintenance of facilities, research, or support of scientific symposia. This figure is almost four times higher than that we had at the end of the period covered by the last PPR.

B. Special facilities/equipment used by the department. Changes over the last seven years and priority needs for the future.

Faculty have assigned research space (~ 600 sq. ft.) and receive start-up funds to equip their laboratories, which are located in McCarthy Hall (MH) or Dan Black Hall (DBH). While our research labs are well equipped, some of the equipment is aging. Additionally, faculty with well-funded active labs do not have enough space to increase the number of students they can support or to add additional necessary equipment. We have several shared facilities that are utilized by faculty, including high-speed, bench-top, and ultra-centrifuges, -80°C freezers, a BioRad real-time PCR machine, Nanodrop spectrophotometers, microplate readers, temperature-controlled shaking incubators, autoclaves, a cell-culture facility with tissue culture hoods and an inverted microscope, Milli-Q water systems, gel documentation stations, fluorescence microscopes, a walk-in cold room, and temperature controlled rooms in MH as well as several incubators in MH and DBH.

The department also has spaces to maintain teaching collections of invertebrates (marine and terrestrial), algae, plants, and vertebrates. In addition, the department maintains several dedicated animal facilities to support research and teaching needs. Some of the facilities were once spread out throughout common areas of MH. Still, the completion of the MH Second Floor renovation was able to consolidate these facilities, which in turn increased the efficiency of their management.

The MH second floor has been recently renovated, and although there was practically no net gain in space, some of the facilities are more up-to-date. Modular classrooms were installed during the construction for lectures typically scheduled on this floor, and they are still in use for some of the Biology course offerings. The newly renovated second floor includes a variety of communal spaces designed to enhance student learning and faculty collaboration. These include a student terrace, two informal learning suites, three informal learning spaces, four huddle rooms, three study pods, an ample lecture space, and a conference room. The renovation of the Biology Department introduced three faculty neighborhoods to promote interdisciplinary interaction, a dedicated supplemental instruction room, a computer lab (24 workstations) that serves upper-division statistics, bioinformatics, and population genetics courses, and three teaching labs. The space also houses 16 faculty offices, two research labs, and the Fay A. McFadden Herbarium. While these renovations have improved the department's infrastructure, the demand for research and instructional space continues to grow, necessitating future planning to accommodate expanding faculty needs and evolving pedagogical approaches. In particular, there is an urgent need for spaces where graduate students can build community and share with their peers. A space for the Biology Graduate Student Club and a Graduate student lounge in either MH or DBH are two priorities identified in the annual biology graduate student survey.

The Department of Biological Science maintains a fleet of vehicles to support field trips for instruction and research and facilitate local mobility for staff. The fleet consists of three trucks: two Ford (purchased in 2005 and 2019) and a Chevy (purchased in 2022), along with a Chevy SUV (purchased in 2011) and a Chevy van (purchased in 2013). Due to age and wear, at least three of these vehicles require replacement. While the department has planned to buy a new truck this year to ensure continued support for field-based learning and research activities, the department lacks resources to replace all three vehicles.

The Department of Biological Science has a 1,400 sq. ft. electronic equipment workshop and a 1,400 sq. ft. woodshop for maintenance and repairs.

The Department of Biological Science maintains a microscopy facility that supports both research and teaching needs. The facility houses an Olympus Fluoview FV-3000 confocal microscope equipped with three lasers (405nm, 488nm, and

561nm), differential interference contrast (DIC) capabilities, and deconvolution software for high-resolution imaging. For electron microscopy, the department has a Hitachi S-2400 scanning electron microscope (SEM) and a JEOL JCM-7000 benchtop SEM, which includes a tilt goniometer to facilitate detailed surface imaging and analysis. In addition, the department possesses a range of fluorescence and stereo microscopes to accommodate diverse research and teaching applications. These include Olympus BH60, BH40, and BH41 fluorescent microscopes with phase contrast, DIC, digital imaging capabilities, and a Leica MZ FLIII fluorescent stereo microscope with a digital camera. The department also maintains Olympus SZH10 and SZX12 stereo microscopes for specimen dissection and imaging. For sample preparation, the facility includes two ultramicrotomes (Reichert-Jung Ultracut E and LKB5) for thin-sectioning biological specimens, a Pelco 91000 sputter coater for sample coating in electron microscopy, an SPI-DRY critical point dryer for biological specimen preservation, and a Durst Laborator 45 EM optical enlarger for photographic processing. Additionally, the department has around 200 compound microscopes and about 100 stereo (dissecting) microscopes used in teaching laboratories.

The Biological Science Greenhouse Complex was established in 1963. It houses a diverse collection of plants for lectures, labs, and research, providing essential space and facilities for hands-on learning. Hundreds of students pass through the greenhouse each semester as they study plant biology and biodiversity. Additionally, the greenhouse supplies specimens to other universities and organizations, a common practice in the field. While we manage to maintain operations, the facility needs renovation. The greenhouse plays a vital role in our department for educational and research purposes. Yet, significant upgrades are required to continue serving these functions effectively and to allow research that requires plants to grow under controlled conditions.

C. Current library/research resources.

The library hosts a dedicated [Biological Science webpage](#) that provides a wealth of information and resources for students and faculty. This page includes links to numerous databases, discovery tools, various services, and free software downloads. Additionally, it features a list of open-access agreements that allow faculty to publish at no cost in hundreds of open-access journals. The library also provides dedicated pages for key courses, including [Cellular and Molecular Biology](#) (BIOL151) and [Evolution and Organismal Biology](#) (BIOL152), as well as [Professional Aspects of Biology](#) BIOL500 A and B, a required course for all incoming graduate students. In summary, the library facilities are adequate as long as the interlibrary loan system continues to be efficient and quick.

VII. Long-term Plans

A. Department's long-term plan (See Appendix E)

B. How long-term plan implements the University's strategic plan and the department's goals.

C. Kinds of evidence to be used to measure the department's results in pursuit of its goals.

D. Resources (internal and external) that may be necessary, available, and/or attainable to meet the department's priorities.

The Department of Biological Science plans to remain student-centered and to develop and implement programs and activities that enhance student learning and success. The department is committed to science education through experiential learning, achieved by instructional approaches that include practice in the scientific method and hands-on experience at the bench or in the field, beginning in the Biology core and progressing to upper division courses that integrate faculty research. All full-time faculty have active research labs providing students with opportunities for faculty-mentored student research or internships, and maintaining and strengthening the department's and university's support for research because of its importance in recruiting and retaining excellent faculty, maintaining currency in the discipline, and engaging students in hands-on learning to develop essential skills. We plan to build on our successes and strengths and seek resources to

implement or expand effective student-centered programs that meet the department's goals (page 2) and align with the University's goals and Strategic Plan.

The following table details our long-term priorities and how they align with the University's Strategic Plan 2025-2029 (Fullerton Forward). Information responding to A-D prompts is in the table.

Long-Term Plans — Priorities — Alignment with Fullerton Forward, the CSUF Strategic Plan 2024-2029

Priority (not in a particular order)	Main Alignment Goal and Objective
The department has had several events, including the enormous impact of the COVID-19 pandemic, MH 2 nd floor renovation, and changes of department chairs, that made long-term planning efforts challenging.	
Curriculum, Advising, and Assessment	
Conduct a comprehensive analysis of our foundational courses, BIOL 151 and 152, to identify trends in student preparedness that may predict challenges in successfully completing the course. The findings will guide potential interventions beyond the current voluntary Supplemental Instruction support, including evaluating the necessity of prerequisites similar to those required for other Biology major courses (such as passing the Chemistry Placement Exam or CHEM 115 and meeting math proficiency through the Math Qualifying Exam, ALEKS, or MATH 15) to ensure students are ready for college-level Biology.	University's goals of a) broadening access for diverse learners and ensuring students have the foundational skills to succeed in higher education (BIOL 151 analysis to identify predictors of insufficient preparation) and b) addressing structural barriers that impact student progress (placement exams and prerequisites). OBJECTIVE 1.1
Identify and address obstacles to graduation related to course availability and scheduling.	University's objective to ensure students have a smooth experience accessing academic offerings . OBJECTIVE 1.1
Building on the modifications made to concentrations in the previous evaluation cycle, continue analyzing course offerings and prerequisite requirements at the 400 level to ensure consistency across concentrations. Streamline student pathways through the upper-division curriculum.	University's objective of optimizing pedagogical strategies to support diverse students and create clearer pathways to degree completion . OBJECTIVE 1.2
Identify ways to reduce master's students time to graduation and establish limits on the duration for which students who have completed all coursework and lab requirements can remain enrolled in GRAD 700.	University's objective of optimizing pedagogical strategies to support diverse students and create clearer pathways to degree completion . OBJECTIVE 1.2
Develop programs and strategies within the master's degree program to create a clear and structured pathway for graduate students pursuing a PhD, including applying to the Bridges to PhD programs funded by NIH.	University's objective of expanding and diversifying educational offerings to prepare students beyond their degrees. OBJECTIVE 1.2.
Enhance and streamline undergraduate student advising by faculty in partnership with the Student Success Team to accommodate the large number of majors and students changing their major to Biology.	University's goals of increasing advising and mentoring capacity and streamlining academic support services and increasing faculty-student engagement to improve retention and graduation rates. OBJECTIVE 1.3

Priority (not in a particular order)	Main Alignment Goal and Objective
Access to and Support for High Impact Practices	
Expand student access to faculty-mentored research, academic internships, study-away/abroad programs, and integrative or interdisciplinary capstone experiences. Develop new courses that offer students an authentic research experience (CURE).	University’s objectives of expanding high-impact experiential learning opportunities and diversifying educational offerings to improve student learning outcomes and meet evolving workforce needs. OBJECTIVE 1.2.
Increase student awareness of the diverse career paths in Biology and the academic pathways within each concentration by expanding the department website, showcasing alumni in various careers on social media, and promoting specialized programs, particularly those supported by external funding.	University’s objective of increase student engagement opportunities and providing signature experiences that help students connect their academic experiences to future career opportunities . OBJECTIVE 2.1. University’s objective of attracting externally funded programs . OBJECTIVE 4.3.
Diversify and Increase the Size of the Department's Faculty & Staff	
Hire additional faculty with expertise in Cell and Molecular Biology and a faculty with expertise in Plant Molecular Biology/Plant Ecology to replace current FERP faculty. Fill any future opening faculty lines arising from retirements and separations as laboratory and office spaces become available. To be competitive with other CSUs, this will require start-up funds of \$200,000 to \$300,000.	University’s objective to increase the number and diversity of faculty and staff through targeted and equitable recruitment strategies . Securing competitive start-up funds aligns with the objective developing equitable and sustainable strategies to attract and reward qualified candidates to join the university. OBJECTIVE 3.1.
Fill any staff positions that become available due to retirements and separations.	
Infrastructure and Equipment	
Contribute to the design of the new Science Laboratory building, currently in the planning and fundraising phase, to ensure it supports or enhances opportunities for students to engage in high-impact experiential learning.	University’s strategy to modernize and expand campus infrastructure in a way that supports academic success. OBJECTIVE 4.1.
Continue maintaining the Equipment Replacement Plan and Priority List to ensure the timely replacement of aging laboratory equipment essential for instructional continuity. Priority will be given to replacing outdated equipment no longer supported by manufacturers and acquiring versatile new equipment that enhances instructional capabilities as funding becomes available.	
Advocate to the Dean’s Office and Academic Affairs for funding to support instructional activities by securing resources for equipment purchases, repairs, and replacements.	

Priority (not in a particular order)	Main Alignment Goal and Objective
Grants, Contracts, and Philanthropic Funds	
Continue pursuing external funding opportunities to support our mission and goals while increasing overall external funding levels by engaging in activities that identify funding sources and streamline the application process.	University's priority to increase fundraising and philanthropic investments at all levels of the university as well as to increase externally funded research and scholarly activities . OBJECTIVES 4.2 and 4.3.
Increase department engagement with Alumni and Donors to support student scholarships and explore potential crowd-sourcing opportunities.	University's goal to improve alumni engagement and expand networking opportunities for students and faculty. OBJECTIVE 4.4.
Outreach and Recruitment	
Develop an outreach and recruitment plan to attract graduate students from CSUF's undergraduate population, other CSU campuses, and country-wide. Strategies will include faculty promoting the program during seminars at different institutions, highlighting opportunities at conferences, using social media, and other targeted recruitment efforts.	University's goal of broadening access to higher education , especially for students from diverse and underserved backgrounds . OBJECTIVE 1.1. University's aim to increase diversity in academic programs , ensuring equitable access to research and professional training opportunities. OBJECTIVE 3.1.
Increase our MS program enrollment to higher than current levels (about 75).	University's aim of diversifying and expanding educational offerings to meet workforce demands and prepare students for advanced degrees and professional careers . OBJECTIVE 1.2. University's efforts to stronger alumni engagement and networking opportunities , helping students transition into research careers and industry positions. OBJECTIVE 4.4
Graduate Student Support	
Identify and implement strategies to enhance support for MS students, such as advocating for tuition waivers for all Teaching Associates .	University's commitment to providing equitable and comprehensive academic support , ensuring that graduate students can focus on their education without financial burdens. OBJECTIVE 1.3.
Seek and develop opportunities to increase funding for graduate student research supplies, travel, and summer research stipends.	University's commitment to providing equitable and comprehensive academic support , ensuring that graduate students can focus on their education without financial burdens. OBJECTIVE 1.3. University's commitment to expand externally funded research and scholarly activities . OBJECTIVE 4.4.
Advocate for graduate students by highlighting their vital contributions to undergraduate education within our program.	University's goal to increase innovative support programs that promote faculty teaching, scholarly and creative activities . OBJECTIVE 3.3.
Planning and Evaluation	
Perform a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis.	University's commitment to continuous improvement in academic offerings and ensuring that academic programs provide high-quality, equitable, and engaging learning experiences . OBJECTIVE 1.2.

Priority (not in a particular order)	Main Alignment Goal and Objective
Evaluate our department and program using the <u>PULSE Vision and Change Rubrics</u> . These assess the department’s alignment with the Vision and Change initiative and can help inform us of our strengths and areas for improvement.	University’s commitment to continuous improvement in academic offerings and ensuring that academic programs provide high-quality, equitable, and engaging learning experiences . OBJECTIVE 1.2. University’s goal of developing a culture of data-informed decision-making . OBJECTIVE 5.2.
Organize one or more departmental retreats for faculty to collaboratively develop a strategic plan that aligns with the new University Strategic Plan, outlining hiring, curricular, and infrastructure priorities for future years.	University’s goal to engage faculty and staff in structured professional development and long-term department growth efforts . OBJECTIVE 3.3.
Community Building	
Cultivate a strong sense of community among faculty, students, and staff to ensure a shared commitment to achieving the department’s goals.	University’s goal to enhance student engagement opportunities and strengthen a sense of belonging . OBJECTIVE 2.1
Create a supportive environment that enhances faculty and staff productivity while fostering collaboration and engagement in advancing the department's mission, goals, and strategies.	University’s goal to establish a campus climate that fosters inclusion, belonging, and engagement . OBJECTIVE 3.2
Promote faculty participation in collegial governance while optimizing faculty time and streamlining decision-making processes for greater efficiency.	University’s concept of shared governance, which is at the heart of the “Fullerton Way”. OBJECTIVE 3.3.
Improve communication among faculty, staff, and students by utilizing both digital and traditional technologies.	University’s goal to establish a campus climate that fosters inclusion, belonging, and engagement . OBJECTIVE 3.2
Plan department social events and research colloquia.	University’s aim is to strengthen a sense of belonging . OBJECTIVE 2.1
Expand the department's social media presence to engage with students in their digital spaces.	
A long-term budget development awaits clarification about looming budget cuts.	

VIII. Appendices Connected to the Self-Study

- A. Undergraduate Degree Programs
- B. Graduate Degree Programs
- C. Faculty
- D. Resources
- E. Long-term planning
- F. *Curriculum Vitae* of faculty (which should include recent scholarly/creative activity and any research funding)

APPENDIX A. UNDERGRADUATE DEGREE PROGRAMS

Table 1. Undergraduate Program Applications, Admissions, and Enrollments

For each undergraduate degree program, a table will be provided with the number of student applications, the number of students admitted, and the number of new enrollments.

Table 1-A. First-Time Freshmen: Program Applications, Admissions, and Enrollments

Fall	# Applied	# Admitted	# Enrolled
2017	3771	2302	363
2018	4584	2633	370
2019	4585	3056	436
2020	4211	3380	457
2021	4285	3212	304
2022	4410	3595	339
2023	5238	4685	516

Table 1-B. Upper-Division Transfers: Program Applications, Admissions, and Enrollments

Fall	# Applied	# Admitted	# Enrolled
2017	682	222	43
2018	757	258	47
2019	819	284	50
2020	803	405	70
2021	827	438	72
2022	737	468	67
2023	616	493	75

Table 2. Undergraduate Program Enrollment in FTES

For each undergraduate degree program, a table will be provided showing student enrollment for the past seven years, including lower- and upper-division enrollment.

Table 2-A. Undergraduate Program Enrollment by Course-Based FTES

Academic Year (Annualized)	Enrollment in FTES		
	Lower-Division FTES ¹	Upper-Division FTES ²	Total FTES
2017-2018	594.52	254.74	849.26
2018-2019	613.39	254.06	867.45
2019-2020	629.83	272.46	902.28
2020-2021	615.20	305.38	920.58
2021-2022	590.97	318.35	909.32
2022-2023	623.16	303.21	926.37
2023-2024	689.80	314.86	1004.66

¹ All students' FTES enrolled in lower-division courses of the program, regardless of student major.

² All students' FTES enrolled in upper-division courses of the program, regardless of student major.

Table 2-B. Undergraduate Program Enrollment (Headcount & FTES by Major Only)

Academic Year (Annualized)	Majors						
	Lower-Division		Upper-Division (Including Post-Bac & 2 nd Bac)		Total		
	Headcount	FTES ¹	Headcount	FTES ²	Headcount	FTES ³	FTES per Headcount
2017-2018	557	508.50	734.5	595.50	1291.5	1104.00	0.85
2018-2019	587	552.10	673.5	549.40	1260.5	1101.50	0.87
2019-2020	642	604.67	703.5	589.27	1345.5	1193.93	0.89
2020-2021	725	673.30	759	652.03	1484	1325.33	0.89
2021-2022	603.5	552.90	830	701.50	1433.5	1254.40	0.88
2022-2023	527	482.93	831	695.53	1358	1178.47	0.87
2023-2024	691	632.57	795.5	672.67	1486.5	1305.23	0.88

¹ FTES of the lower division students who are majoring in the program.

² FTES of the upper division students who are majoring in the program.

³ FTES of all students who are majoring in the program.

Table 3. Graduation Rates for Degree Program

For each undergraduate degree program, tables will be provided showing the 4-year, 5-year, and 6-year graduation rates and Pell and underrepresented status equity gaps for 6-year graduation rates by program for all majors at entry. Table 3-A will summarize the first-time, full-time freshman graduation rates. Table 3-B will summarize the transfer student graduation rates.

Table 3-A. First-Time, Full-Time Freshmen Graduation Rates

Entered in Fall	Cohort	% Graduated			Equity Gap*	
		In 4 Years	In 5 Years	In 6 Years	By Pell Status	By UR Status
2014	213	16.9%	56.3%	71.4%	56.9%	3.1%
2015	231	23.4%	63.6%	73.6%	5.7%	5.7%
2016	300	27.3%	57.0%	67.0%	67.9%	9.1%
2017	344	25.3%	54.9%	63.7%	57.4%	11.5%
2018	365	31.8%	64.1%	72.1%	65.8%	9.4%
2019	431	26.9%	52.4%	N/A	N/A	N/A
2020	428	27.1%	N/A	N/A	N/A	N/A

**Note: Equity gap is calculated as the percentage point difference in six-year graduation rates between two sub-populations of each cohort year (e.g., 2014 non-UR six-year graduation rate – 2014 UR six-year graduation rate). Please consider cohort sizes when interpreting the equity gap data.*

Table 3-B. Transfer Student Graduation Rates*

Entered in Fall	Cohort	% Graduated		
		In 2 Years	In 3 Years	In 4 Years
2016	80	10.0%	36.3%	56.3%
2017	43	9.3%	51.2%	67.4%
2018	47	17.0%	42.6%	72.3%
2019	50	16.0%	58.0%	72.0%
2020	72	8.3%	47.2%	61.1%
2021	72	11.1%	51.4%	N/A
2022	68	13.2%	N/A	N/A

**Note: Starting with the Fall 2019 cohort, both state-support and self-support matriculated students are included in the cohorts.*

Table 4. Degrees Awarded

For each undergraduate degree program, a table will be provided showing the number of primary degrees awarded for the seven most recent college years for which data are available.

Table 4. Degrees Awarded

College Year	Degrees Awarded
2017-2018	214
2018-2019	181
2019-2020	211
2020-2021	173
2021-2022	235
2022-2023	211
2023-2024	242

APPENDIX B. GRADUATE DEGREE PROGRAMS

Table 5. Graduate Program Applications, Admissions, and Enrollments

For each graduate degree program, a table will be provided showing the number of student applications, the number of students admitted, and the number of new enrollments.

Table 5. Graduate Program Applications, Admissions, and Enrollments

Fall	# Applied	# Admitted	# Enrolled
2017	51	15	7
2018	40	19	12
2019	36	22	14
2020	45	21	17
2021	32	18	14
2022	41	18	15
2023	38	23	20

Table 6. Graduate Program Enrollment by Headcount and FTES

For each graduate degree program, tables will be provided showing student enrollment for the past seven years by headcount and FTES.

Table 6. Graduate Program Enrollment by Headcount and FTES

Academic Year (Annualized)	Headcount	FTES	FTES per Headcount
2017-2018	50.5	26.42	0.52
2018-2019	52.5	27.92	0.53
2019-2020	53.5	26.92	0.50
2020-2021	57	30.08	0.53
2021-2022	52	27.54	0.53
2022-2023	54.5	26.38	0.48
2023-2024	59	30.58	0.52

Table 7. Graduate Student Graduation Rates

For each graduate degree program, a table will be provided showing the graduate rates for master's or doctoral programs.

Table 7-A. Graduation Rates for Master's Programs

All Master's Entered in Fall:	Cohort	% Graduated		
		In 2 Years	In 3 Years	In 4 Years
2016	11	0	27.3	53.80
2017	7	12.5	28.60	42.90
2018	12	8.3	16.70	75.00
2019	14	13.3	28.60	28.60
2020	17	0	17.64	47.05
2021	14	0	35.71	N/A
2022	15	6.66	N/A	N/A

Table 8. Master's Degrees Awarded

For each graduate degree program, a table will be provided with the number of degrees awarded.

Table 8. Graduate Degrees Awarded

College Year	Degrees Awarded
2017-2018	23
2018-2019	12
2019-2020	17
2020-2021	14
2021-2022	20
2022-2023	12
2023-2024	12

APPENDIX C. FACULTY

Table 9. Full-Time Instructional Faculty

For the seven most recent fall terms, a table will be provided with the number of tenured faculty, number of faculty on tenure-track, number of faculty on sabbatical, number of faculty in FERP, number of full-time lecturers, and full-time faculty equivalent (FTEF) as of fall term.

Table 9. Faculty Composition¹

Fall	Tenured	Tenure-Track	Sabbaticals at 0.5	FERP at 0.5	Full-Time Lecturers	Actual FTEF
2017	19	8	0.5	0.5	6	33.0
2018	20	7	1.5	0.5	4	31.0
2019	22	4	1.0	0.5	3	29.0
2020	23	3	1.5	0.5	3	29.0
2021	26	1	0.5	0	5	32.0
2022	26	1	1.5	0	4	31.0
2023	24	1	0.5	0	8	33.0

¹ Headcount of tenured, tenure-track, sabbaticals at 0.5, and FERP at 0.5 includes full-time and part-time faculty. Headcount of lecturers only includes full-time faculty, as consistent with the IPEDS HR definition. It does not represent the number of full-time lecturer lines assigned to the department.

APPENDIX D. RESOURCES

Table 10. Resources

Provide a table showing for the past five years all department resources and the extent to which each is from the state-supported budget or from other sources, such as self-support programs, research, contracts and/or grants, development, fund-raising, or any other sources or activities.

Table 10a. Overall Summary of Department Spending/Budget – State Support

Fiscal Year	Full-Time Faculty*	Teaching Associates & Graduate Assistants*	Part-Time Faculty*	Total PTF Blanket*	Operating Expenses & Student Assistants
2016-2017	\$2,558,247.83	\$483,811.88	\$ 512,026.86	\$ 995,838.74	\$308,138.36
2017-2018	\$2,368,382.24	\$500,138.28	\$ 642,819.28	\$1,142,957.56	\$322,904.91
2018-2019	\$2,403,432.55	\$511,521.27	\$ 665,310.19	\$1,176,831.46	\$283,077.99
2019-2020	\$2,288,649.43	\$497,358.49	\$ 882,788.76	\$1,380,147.25	\$497,537.59
2020-2021	\$2,306,590.26	\$357,063.84	\$ 887,792.81	\$1,244,856.65	\$179,824.18
2021-2022	\$2,701,376.59	\$371,059.05	\$ 923,325.71	\$1,294,384.76	\$299,653.92
2022-2023	\$2,627,022.59	\$247,802.28	\$1,143,601.27	\$1,391,403.55	\$608,430.33
2023-2024	\$2,741,001.30	\$296,365.49	\$1,439,820.48	\$1,736,185.97	\$497,230.35

* This is the amount spent

Table 10b. Extramural grant funding obtained by the department from 2016–2017 to 2023–2024

Fiscal Year	Total Extramural Grant Funds Obtained*
2016–2017	\$ 2,229,241.00
2017–2018	\$ 5,100,157.00
2018–2019	\$ 1,133,850.00
2019–2020	\$ 3,632,902.00
2020–2021	\$ 992,294.00
2021–2022	\$ 1,780,011.00
2022–2023	\$ 6,245,357.00
2023–2024	\$ 1,580,029.00

* This is the amount obtained during that year. Grant funding may last for several years

APPENDIX E. LONG TERM PLANNING

The unit will need to first develop goals regarding student learning, scholarship, and service outcomes and then develop criteria for assessing whether they have been achieved. Important quality outcomes may include the definition and analysis of student academic work/achievement; impacts of research and scholarly activity on the discipline, the institution, and the community; impacts of service on the discipline, the institution, and the community; and the marks of a successful graduate from a program in this unit.

Using the information provided in the appendices (e.g., graduation rates, faculty composition, FTES enrollment), determine how they inform and influence the long-term goals of the department or degree program.

All pertinent information is embedded in the body of the document.

APPENDIX F. *CURRICULUM VITAE* OF FACULTY

Faculty curriculum vitae are accessible [here](#).