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Life Science Program Review

2020

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1. OVERVIEW OF THE PROGRAM

a). Narrative Description

The Life Science program is designed to prepare students interested in progressing to the nursing and allied health careers and/or those interested in transferring to four-year colleges or universities. Our program goal is to build up the students' understanding of biological principles, structure, function of living organisms, and the interactions with the physical aspects of the environment. The scope of the program includes the fields of biology, anatomy, physiology, environmental biology, and microbiology.

The Mission of the Life Science Program is to offer quality educational opportunities for students by providing courses to offer associate degrees, and certificate courses that meet general education requirements. Continuing optimal academic standards, guaranteeing availability of academic & student support services, providing facilities to support teaching and learning, and supporting professional development for faculty.

The Life Science program fulfills three educational roles for students:

1. providing general education options for non-majors,
2. offering lower division courses for life science majors, and
3. preparing students for entry into various health-related fields and programs.

b). Degrees/Certificates Offered

The program offers courses that satisfy the General Education requirements for students to obtain either an Associate of Arts (A.A.) degree in General Studies with a Biological and Physical Sciences Emphasis or an Associate in Science (A.S.) degree in General Sciences. Many of the Life Sciences courses fulfill the requirement of transfer institutions including California State University (CSU) and the University of California (UC) systems for a science course with a laboratory section. Furthermore, many of the courses in the Life Sciences program satisfy prerequisite course requirements for students who will transfer and major in biology, botany, zoology, microbiology, molecular biology, anatomy, physiology, nursing, allied health, pre-dentistry, pre-veterinary, or pre-medicine. Students in this program may graduate with an A.S. or A.A. degree.

c). Alignment with Mission Statement and Strategic Initiatives

The Life Sciences Program is aligned with the Mission statement because we have established a welcoming and inclusive community in our program. Our program provides clear pathways for completion. The program is aligned with the Strategic Initiatives. Our degree program meets the needs of our students in terms of our course offerings, many of whom want to pursue careers in allied health and/or transfer to a four-year college or university. This department has developed guided pathways for our degrees so that students will have a clear path to completion. Our program offers quality educational programs tailored to our diverse student community. Also, the Life Science faculty developed and utilized various assessment tools to monitor stated Student Learning Outcomes (SLO) and the faculty have trained to enter the data in Nuventive, a college-wide online repository of SLO results. The faculty have strengthened the student success efforts by adding supplemental instruction and collaborating with the Learning Resource Center to track Learning Outcomes.

Life science department has media projectors and whiteboards installed in all classrooms and campus-wide Wi-Fi network for instruction and class activities. The Faculty actively develops relationships with high schools, colleges, businesses, and community-based organizations to help collaborate on ways to improve Learning Outcomes. The faculty and students of the Life Science program are involved in campus-wide social programs such as celebrating different cultural and historical activities which include Martin Luther King Day, Cesar Chavez Day, Cinco de Mayo, Black History Month observance, musical presentations, and cultural exhibits.

d) . Status of Previous Recommendations

The recommendations which included materials required to meet our Student Learning Outcomes (SLO's) in our courses have been purchased (e.g. purchase dissection specimens and other consumables, microscope repair, etc.), but none of our other recommendations have been funded. Neither the number one recommendation in terms of priority nor the least expensive recommendation have been funded. The unfunded recommendations in the previous program review have been included in this program review as those are still needed in addition to new needs that have arisen.

e). Highlights and Future Vision

One of the highlights of the Life Sciences Program is that the faculty sponsored a successful community-based Student Research Symposium every year since the spring of 2014 to showcase the science research of the students on our campus. Student-led research is a proven high impact educational practice that allows students to receive close mentorship from a professor while implementing the scientific method and developing critical thinking skills. This type of research experience is highly beneficial to our students. Therefore, we have continued to hold this event every spring and intend to continue it in the future.

2. ANALYSIS OF RESEARCH DATA OF THE PROGRAM

This section contains the analysis of data provided by Institutional Research from Fall 2014 to Spring 2019.

a) Head Count of Students in the Life Science Program

The head count shows a steady increase of students in all life science courses in 2014-2019. Since other local colleges are limited in their capacity to offer these in-demand courses, many students come from outside of our district to take advantage of the classes we offer.

Life Sciences Head Counts Fall Terms 2014-2018						
		Term				
		2014	2015	2016	2017	2018
Term Head Count		635	656	674	706	763
Gender	F	485	498	502	547	544
	M	150	158	172	159	219
Ethnicity	Asian	67	94	88	100	90
	Black	182	147	160	138	170
	Latinx	324	334	362	406	423
	Alaskan / American Indian	<5	<5	<5	<5	<5
	Pacific Islander	7	7	<5	<5	<5
	Two or More	19	28	21	29	31
	White	33	41	39	31	41
	Unknown or Decline	<5	<5	<5	<5	<5
Age / Age Group	<17	<5	<5	<5	<5	<5
	17	<5	<5	<5	<5	8
	18	12	12	11	6	11
	19	38	22	23	24	30
	20	46	49	47	67	56
	21	65	52	70	51	76
	22	60	62	56	67	67
	23	59	53	59	66	65
	24	60	55	45	66	52
	25-29	126	168	185	194	193
	30-39	100	126	119	116	144
	40-49	46	39	40	36	50

	50-64	23	16	16	12	9
	65+	<5	<5	<5	<5	<5
Class Load	Full-time	75	65	45	45	51
	Part-time	560	591	629	661	712
Educational Goal	Basic Skills	<5	<5	<5	<5	<5
	Degree/Cert Only	60	50	54	51	40
	Enrichment	5	21	27	22	31
	Intend to Transfer	173	190	214	210	232
	Retrain / Recertify	15	21	14	25	38
	Undecided/Unstated	381	374	364	397	420

Life Sciences Head Counts Spring Terms 2015-2019						
		Term				
		2015	2016	2017	2018	2019
Term Head Count		586	654	733	774	710
Gender	F	432	484	539	555	540
	M	154	170	194	219	170
Ethnicity	Asian	76	89	102	108	106
	Black	157	148	162	169	158
	Latinx	297	353	403	431	387
	Alaskan / American Indian	<5	<5	<5	<5	<5
	Pacific Islander	7	<5	<5	<5	<5
	Two or More	17	14	22	20	17
	White	26	45	42	42	30
	Unknown or Decline	<5	<5	<5	<5	9
Age / Age Group	<17	<5	<5	<5	<5	<5
	17	<5	<5	<5	<5	7
	18	16	12	12	10	16
	19	37	32	32	43	47
	20	41	51	61	78	49
	21	56	68	74	71	66
	22	61	56	67	77	54
	23	52	57	64	61	59

	24	50	62	47	53	47
	25-29	127	146	194	201	162
	30-39	89	116	123	134	134
	40-49	38	39	44	33	57
	50-64	15	14	13	11	11
	65+	<5	<5	<5	<5	<5
Class Load	Full-time	61	59	59	69	66
	Part-time	525	595	674	705	644
Educational Goal	Basic Skills	<5	<5	<5	<5	<5
	Degree/Cert Only	47	48	53	51	43
	Enrichment	22	17	19	23	26
	Intend to Transfer	179	189	219	231	221
	Retrain / Recertify	20	16	21	18	26
	Undecided/Unstated	316	383	419	447	391

Gender: Females outnumbered males in the Life Science program by approximately 3:1. During the time period studied, the percentage the number of females in the Life Science program in 2015 ranges from 432 to 540 in 2019 (80%). Whereas the male student's enrolment increased from 154 (2015) to 170 in 2019. While the ratio of female to male remained fairly constant, the overall trend is an increase in student counts over time. Notably, the Life Science program has a disproportionately higher number of female students than male students when compared to the campus student number (65% female, 35% male according to COMPTON COLLEGE ANNUAL FACT BOOK, 2018-2019). One possible explanation is that most of the students in our program pursue traditionally female-dominated careers including nursing or other healthcare-related careers. According to beckershospitalreview.com in 2015 the ratio of female to male nurses 9.5 to 1 (nationwide) and 5.8 to 1 in California. Recruitment efforts targeting the males on campus may be a potential area for enrollment growth in the Life Science program.

Ethnicity: The Life Science program serves an ethnically diverse student body. A majority of our students served are Latinx. The percentage of Latinx students consistently increased from 297 (2015) to 387 (2019) in spring and from 324 (2014) to 423 (2018) in fall. The number of African American students decreased from the 2014-2015 academic year to the subsequent year and then stabilized around 22%. The overall percentage of 53.8% Latinx students was lower in the Life Science program as compared to the Compton College overall percentage of 61% according to COMPTON COLLEGE ANNUAL FACT BOOK, 2018-2019. Hence, recruitment of this demographic of students is one potential area for growth. The overall percentage of Asian students is 13.3% which is higher than the college average of 7%. White students represent about 5.4% of students in Life Science program compared to 4% for the college.

Age-Structure: The age range for Life Science students goes from younger than 17 to over the age of 65. The majority fall in the age 18-24 range with a sizeable number in the 25-29 and the 30-39 age ranges as well.

Class load: The vast majority of Life Science students are part-time, which is true of the overall population of students at the college.

Educational goal: Interestingly, over half of the students in the Life Sciences are Undecided/Unstated so this could be an area that the department addresses. However, Guided Pathways model that this department and the entire college has adopted is expected to limit this problem as students minimally have to select a meta major out of five meta majors offered by the college. Many of the students in this department intend to transfer and the courses in this program are designed to support transfer students.

b). Course grade distribution

School Year	Course ID	A	W	Total	Success	Retained	Success Rate	Retention Rate
2014-15	ANAT-30	39	38	211	135	173	63.98	81.99
	ANAT-32	168	230	723	395	493	54.63	68.19
	BIOL-10	31	93	279	149	186	53.41	66.67
	BIOL-101	<5	<5	23	17	19	73.91	82.61
	BIOL-15	8	8	54	42	46	77.78	85.19
	BIOL-17	<5	15	21	<5	6	14.29	28.57
	MICR-33	51	41	249	196	208	78.71	83.53
	PHYO-31	85	49	300	238	251	79.33	83.67
2015-16	ANAT-30	20	33	124	75	91	60.48	73.39
	ANAT-32	202	182	770	480	588	62.34	76.36
	BIOL-10	48	65	328	215	263	65.55	80.18
	BIOL-101	10	7	31	21	24	67.74	77.42
	BIOL-102	11	<5	22	21	21	95.45	95.45
	BIOL-15	<5	7	15	<5	8	33.33	53.33
	MICR-33	63	40	284	231	244	81.34	85.92
	PHYO-31	121	60	373	298	313	79.89	83.91
2016-17	ANAT-30	15	24	98	60	74	61.22	75.51
	ANAT-32	192	221	796	474	575	59.55	72.24
	BIOL-10	48	53	355	235	302	66.2	85.07
	BIOL-101	9	15	38	19	23	50	60.53
	BIOL-102	9	<5	26	23	24	88.46	92.31
	BIOL-15	<5	<5	13	6	11	46.15	84.62
	MICR-33	77	50	306	250	256	81.7	83.66
	PHYO-31	137	69	433	341	364	78.75	84.06
2017-18	ANAT-30	13	23	93	45	70	48.39	75.27
	ANAT-32	224	208	850	514	642	60.47	75.53
	BIOL-10	43	75	351	209	276	59.54	78.63
	BIOL-101	8	10	41	21	31	51.22	75.61
	BIOL-102	9	<5	26	22	24	84.62	92.31
	MICR-33	83	56	312	245	256	78.53	82.05
	PHYO-31	147	46	441	356	395	80.73	89.57
2018-19	ANAT-30	14	28	98	62	70	63.27	71.43
	ANAT-32	191	198	799	489	601	61.2	75.22
	BIOL-10	41	62	374	248	312	66.31	83.42
	BIOL-101	12	<5	37	31	32	83.78	86.49
	BIOL-102	15	<5	41	36	38	87.8	92.68
	BIOL-10H	<5	<5	16	9	12	56.25	75
	BIOL-15	7	<5	31	18	26	58.06	83.87
	MICR-33	62	55	311	250	256	80.39	82.32
	PHYO-31	156	44	437	366	393	83.75	89.93

A course that stands out as having consistently high success and retention rates is Biology 102 as compared to our other course offerings. This course is intended for students who will major in biology in preparation for transfer to a 4-year college or university so it is not surprising that students would excel in this course given their motivation. Biology 15 and Biology 17 stand

out for having lower than typical success rates. Possible explanations are that these courses are intended for non-biology majors and that rotating adjunct faculty typically teach these courses so the quality of teaching is more variable. Microbiology 33 and Physiology 31 tend to have higher than typical success and retention rates, which is probably because both of these courses have prerequisites so the students have already proven that they can be successful in college-level science courses. Plus, these students typically have the educational goal to pursue the allied health field which can be quite competitive so their grades really matter to them.

c). Success rates (Discuss your program’s rates, demographic success characteristics and set a success standard for your program.)

Program Success Standard*	65.35%
5-year Program Success Average	67.53%

*Calculated as the average between the 5-year average and the lowest yearly rate in the 5-year period.

Year	Total Grades	Success Rate
2014-15	1860	63.17%
2015-16	1947	69.13%
2016-17	2065	68.18%
2017-18	2114	66.79%
2018-19	2144	70.38%

The Life Science department was not provided with disaggregated success rates of different student groups such as the grades of disproportionately impacted students so we cannot address equity gaps in this program review. Encouragingly, the overall success rate in 2014-2015 of 63.17% has dramatically increased to the 2018-2019 success rate of 70.38%. The success rates have varied from 63.17% to 70.38% during the years analyzed. Notably, this program achieved a higher 5-year program success average of 67.53% than what our program success standard of 65.35% was.

d). Enrollment statistics with section and seat counts and fill rates

Life Sciences	
Term	Fill Rate
Fall 2014	93.71%
Fall 2015	91.33%
Fall 2016	93.70%
Fall 2017	100.40%

Fall 2018	97.86%
Spring 2015	90.67%
Spring 2016	94.32%
Spring 2017	101.31%
Spring 2018	102.81%
Spring 2019	91.07%

This program's fill rates varied from 90.67% to 102.81% and the fill rate for each semester was always over 90%, indicating a good match between the number of sections offered and student demand. However, the fill rate exceeded 100% in Fall 2017, Spring 2017, and Spring 2018 indicating that more sections were needed. Especially in science labs, it is not safe to overload the labs and there often are not extra instruments and equipment (e.g. microscopes) to accommodate additional students.

e). Scheduling of courses (day vs. night, days offered, and sequence)

Life Sciences Enrollment by Time of Day

Term	Fall 14	Spring 15	Fall 15	Spring 16	Fall 16	Spring 17	Fall 17	Spring 18	Fall 18	Spring 19
Day	73.09%	73.70%	70.29%	69.42%	70.26%	70.27%	69.91%	73.11%	74.09%	71.18%
Night	26.91%	26.30%	29.71%	30.58%	29.74%	29.73%	30.09%	26.89%	25.91%	25.86%
Unknown	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.96%

Overall, the enrollment in day courses was much higher (69.42-74.09%) than for night courses (25.86-30.58%).

Anatomy: The percentage of the total enrollment did not increase for day classes in Anatomy despite the increase in sections from 7 to 9 between Spring 2015 and Spring 2019. The percentage enrollment remained steady for night classes. Therefore, day classes had high enrollment.

Biology: Only two sections of Biology 10 were offered in the nights while the day classes included Biology 10, Biology 15, and Biology 101 & 102. Biology 101 is only offered in spring and summer semesters. Biol 102 is only offered in fall semesters. Biol 103 is not offered which some students need to transfer to 4-year institutes.

Microbiology: The number of day and night sections are four in fall and spring while summer only two sections given day and nights since 2014. Evening classes have higher percentage enrollment considering sections offered in day schedule.

Physiology: Considering the sections offered, Spring 2015-day classes had higher percentage enrollment than night classes, but fluctuating number in enrollment is observed during different semesters until 2019.

f). List any related recommendations.

1. According to beckershospitalreview.com in 2015 the ratio of female to male nurses 9.5 to 1 (nationwide) and 5.8 to 1 in California. Recruitment efforts targeting the males on campus may be a potential area for enrollment growth in the Life Science program.
2. The percentage of both Latinx students as well as African American students was slightly lower in the Life Science program when compared to the Compton College overall numbers. Hence, recruitment of this demographic of students is one potential area for growth.
3. Our program needs to increase efforts to recruit more males, African American students, and Latinx students as they are underrepresented in our program as compared to the campus.
4. Faculty in the Life Science program should strategize to incorporate free or lower cost textbooks and other materials into our courses.
5. Faculty in the Life Science program need to improve communication with counselors so that students are directed to register for the courses most appropriate for them.
6. The Life Science program needs to offer hybrid and/or online courses to accommodate students who are seeking a more flexible schedule. We need to improve and standardize better equipment, software, and lab support both for online and face to face labs.
7. Life Science faculty needs to continue to work to improve the success and retention rates in all the courses but most importantly, in Anatomy. We need to have permanent agreements with firms in place for using textbooks, dissection software and virtual labs for anatomy and physiology.

3. Curriculum

a) **Curriculum Course Review Timeline**

All the courses taught in the Life Science program are part of the Compton College curriculum. The Natural Sciences Curriculum Committee with the participation of our Life Science faculty ensures that the course outlines are reviewed and approved by the Compton College Curriculum Committee at least once in the last six years. The timeline for the review process is shown below:

Table: Course Review Cycle for Compton Life Sciences.

Course	Last	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6	
		Fall 19	Spr 20	Fall 20	Spr 21	Fall 21	Spr 22	Fall 22	Spr 23	Fall 23	Spr 24	Fall 24	Spr 25
Anat 130	2014 - 15					X							
Anat 132	2015 - 16							X					
Biol 100	2015 - 16							X					
Biol 101	2016 - 17								X				
Biol 102	2016 - 17								X				
Biol 117	2013 - 14			X									X
Micro 133	2014 - 15					X							
Phyo 131	2013 - 14			X									

Legend: P – In the year of next course review, X - Semester for the next course review

The following eight courses have been taught in the Life Science Program as stated in the Compton Center 2019-2020 catalog:

(1). Anatomy 130 (*Essentials of Anatomy and Physiology*, 4units)

This course is the study of anatomy coupled with physiology. Students compare the structure and function of human organ systems to those of other vertebrates. The laboratory includes dissection of sheep brains and hearts, cow eyes and other vertebrates. Laboratory experiments reinforce principles of anatomy and the basic principles of chemistry, cell biology, histology, embryology, and genetics.

(2). Anatomy 132 (*General Human Anatomy*, 4units)

This in-depth course covers all eleven systems of the human body including related histology and pathology. The systems covered are skeletal, muscular, nervous, integument, respiratory, digestive, reproductive, urinary, endocrine, immune, and lymphatic. Models of the human body and dissection of higher vertebrates are emphasized in laboratory. This course is designed for science, health related, pre-nursing (Bachelor of Science in nursing), and pre-professional majors.

(3). Biology 100 (*Fundamentals of Biology*, 4 units)

This course is a survey of all living things: prokaryotes, protists, fungi plants, and animals. Basic principles of structure, function, and relationships of living organisms are discussed with special reference to humans.

(4). Biology 115 (*Environmental Aspects of Biology*, 3 units)

Basic ecological and biological principles and concepts are emphasized in the study of the structure and function of ecosystems. Major ecological problems such as overpopulation, resource depletion and food production are related to endangered species and habitat degradation. Environmental pollution of air and water resources is considered in local areas as well as national and international situations. Air quality and global warming issues are considered. Students are encouraged to participate in local activities addressing environmental problems and restoring and improving local habitats.

(5). Biology 101 (*Principles of Biology I*, 5 units)

Biology 101 course added in Fall 15 is offered each spring and summer semesters. This course is a survey of eukaryotic organisms, their evolution and ecology. The student will have a thorough exposure to plant and animal anatomy and physiology, and will utilize animal dissection in the lab. Students will be expected to complete a project that includes hypothesis, prediction, experimentation, and presentation of results. This course is one of three courses in the biology series designed for biology majors, including those students planning to pursue a career in medicine, dentistry, or other life sciences.

(6). Biology 102 (*Principles of Biology II*, 5 units))

New Course that was added in Fall 15, is offered each fall semester. This course offers a detailed study of eukaryotic cell anatomy, metabolism, and division, including the study of Mendelian genetics and the molecular genetics of eukaryotes. Prokaryotic cellular structure (Eubacteria and Archaea), microbial genetics, and viruses are also studied. The scientific method is discussed in the lecture component and students implement elements of the process in various laboratory exercises. This course is one of three courses in the biology series designed for biology majors, including those students planning to pursue a career in medicine, dentistry, or other life sciences.

(7). Microbiology 133 (*General Microbiology*, 5 units)

This course is a study of microbial anatomy and physiology, classification, microbes in water, air, soil, food, sewage, and medical aspects of microbiology. It also includes the study of fundamental techniques in the growth, culture, and identification of microorganisms. Students are required to perform laboratory experiments to reinforce the principles of microbiology discussed in lecture. This course is designed for students planning to pursue careers in the health sciences or other life sciences.

(8). Physiology 131 (*Human Physiology*, 4 units)

This course is a study of cellular physiology and the functional aspects of the following human body systems: circulatory, respiratory, digestive, excretory, reproductive, muscle, nervous and endocrine. In the laboratory, experiments are performed to demonstrate principles discussed in lecture. This course is designed primarily for those majoring in the Health Sciences.

b) Course Additions to Current Course Offerings

No new courses have been added to the Life Sciences program in 2019-2020. The courses that were offered in 2018 are the same courses being offered in spring and fall of 2019-2020. However, Compton College is having an active conversation about adding new courses to program in the near future and the research is ongoing. Biology II is still being offered in the fall semester. These two courses are required for transfer and A.S. Biology major students. We plan to offer new courses and programs in biotechnology, which are currently undergoing the curriculum review process.

c) Course Deletions and Inactivation's from Current Course Offerings

Life Science program did not offer Biology 117 (Marine Biology) in 2019-2020 academic year and plan to inactivate it. We have not been offering Biology 103 (Principles of Biology III) because we do not offer the pre-requisite organic chemistry course, but plan to offer both of those courses in the near future.

d) Courses and Number of Sections Offered in Distance Education

Currently Biology 100 is offered as hybrid and Environmental biology is offered as a fully online course in the Life Sciences at Compton College. Biotechnology and Anatomy online courses are in the pipeline and will be offered at Compton College when voted and approved by the Curriculum Committee and the Senate. These offerings and continued modernization of the program will provide students the much needed support and workforce for the industry in the coming years and decades. The instructors at Compton College have moved from Etudes to Canvas online course management system as an enhancement to their face-to-face classes. Technologies such as PowerPoint and video clips are used in our classrooms to increase the breadth and visual scope of lecture / lab materials and to provide various accommodations for the diverse learning styles of our students.

e) Are Courses, Degrees, or Certificates meeting students' transfer or career training needs?

Regarding to the courses, degrees, or certificates and how well they are meeting students' transfer or career training needs:

1. Have all courses that are required for your program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?
All the courses listed above, that are required for an Associate in Science degree in Life Science, have been offered in the last two years. However, the number of course sections offered in Anatomy 132 increased in 2019 as two additional sections were added as the fill rates continued to increase.
2. Are there any concerns regarding program courses and their articulation?
These courses are required for a 4-year degree on transfer to the CSU or UC institutions or Associate in Science degree. All the courses offered in the Life Science, discussed

earlier, are UC and CSU transfer courses as advertised in the Compton Collage 2019-2020 catalog.

3. How many students earn degrees and/or certificates in your program? Do students take licensure exams? If so, what is the pass rate? If few students receive degrees or certificates or if few students pass the licensure exam, should the program's criteria or courses be re-examined? Set an attainable, measurable goal for future degrees, certificates, and/or licensure pass rates.

The Life Science program provides courses (Essentials of Anatomy & Physiology, Anatomy, Biology, Microbiology, and Physiology) that prepare students for admission into Nursing / Allied Health disciplines. Many students also take these courses (e.g. Fundamentals of Biology and Marine Biology) to satisfy their general education requirements. Students who have completed courses offered in the Life Science have graduated with skills to go through training programs and function as Registered Nurses, Nursing Practitioners, Radiology Technicians, and Physician Assistants. Life Science program does not offer certificate or professional license. However, students have to transfer to four-year universities to complete their academic studies in various disciplines for bachelor's degrees or professional licenses.

f) List any related recommendations.

The need for advanced biotechnology training in the health care and industry to fulfill the federal science goals requires the program to keep pace with industry demands and up-to-date knowledge. In order to accomplish these goals, the program requires new laboratory equipment and laboratory spaces. Unfortunately, due to state funding restraints, funding is not commensurate with the growth we have been experiencing. The lack of expanded laboratory space has placed a limit on the number of courses that can be offered and thus the number of students that can be served to meet industry and university demands. The biological sciences program budget can no longer simply absorb the cost of buying laboratory materials, which include dissection specimen, chemicals, modern equipment/technology, equipment maintenance and other consumables.

To improve retention and success rates, Compton College has developed and implemented the Science, Technology, Engineering and Math (STEM) Guided pathway in the program that supports a student-centered approach that can significantly increase the number of students earning community college credentials, while closing equity gaps. This program will guide each student effectively and efficiently from her/his point of entry through to attainment of high-quality postsecondary credentials and careers with value in the labor market.

It is recommended that the Life Sciences program should strive towards smaller class sizes and more course sections for better interaction between students and instructors. Our labs were built for a maximum of 28 seats but the class limit has risen to between 36 and 40. It is our belief that a smaller class size would be more effectively managed by the instructors and will translate into a higher success rate than what we have now. College should better organize existing student support programs and strategically use existing funding to support student success.

Hiring supplemental instructors (SI) would definitely be a great help to our students to support

their academic performance and retention rate. The relatively lower success rates in anatomy and physiology may be improved by offering a combination of Anatomy and Physiology (34A and 34B). This course is UC and CSU transferrable and it is available at the ECC Torrance, and other colleges like the Riverside Community College, Riverside and Pasadena City College, Pasadena. This will give students an alternative route towards completing their courses.

Resuming the *Biology 103* courses is highly recommended for Health Science majors and of great demand among our students. Finally, the Life Science program should continue to invest in faculty/staff development programs, technology and laboratory materials in order to provide the best quality of instruction and achieve the highest level of student success.

4. **Assessment and Student and Program Learning Outcomes (SLOs & PLOs)**

- a) **Alignment Grid which shows how course, program, and institutional learning outcomes are aligned.**

Institutional Learning Outcome (ILO) and Program Learning Outcome (PLO) Alignment Grid					
Program: Life Science		Number of Courses: 17	Date Updated: 03.21.2016	Submitted by: M. Priest, ext. 2314 Modified by Raj Sidhu	
ILO's	1. Critical Thinking <i>Students apply critical, creative and analytical skills to identify and solve problems, analyze information, synthesize and evaluate ideas, and transform existing ideas into new forms.</i>	2. Communication <i>Students effectively communicate with and respond to varied audiences in written, spoken or signed, and artistic forms.</i>	3. Community and Personal Development <i>Students are productive and engaged members of society, demonstrating personal responsibility, and community and social awareness through their engagement in campus programs and services.</i>	4. Information Literacy <i>Students determine an information need and use various media and formats to develop a research strategy and locate, evaluate, document, and use information to accomplish a specific purpose. Students demonstrate an understanding of the legal, social, and ethical aspects related to information use.</i>	
	SLO-PLO-ILO ALIGNMENT NOTES: <i>Mark boxes with an 'X' if: SLO/PLO is a major focus or an important part of the course/program; direct instruction or some direct instruction is provided; students are evaluated multiple times (and possibly in various ways) throughout the course or are evaluated on the concepts once or twice within the course.</i> <i>DO NOT mark with an 'X' if: SLO/PLO is a minor focus of the course/program and some instruction is given in the area but students are not formally evaluated on the concepts; or if the SLO/PLO is minimally or not at all part of the course/program.</i>				
PLO's				PLO to ILO Alignment <i>(Mark with an X)</i>	
				1 2 3 4	
	PLO #1 Language The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.		X		X
	PLO #2 Instruments The student will master the use of appropriate biological tools and evaluate evidence gathered to explain biological principles.			X	
PLO #3 Structures Students will be able to use language and apply concepts learned to the life sciences.		X		X	

Program Learning Outcome (PLO) and Course Student Learning Outcome (SLO) Alignment Grid							
SLO's	SLO to PLO Alignment <i>(Mark with an X)</i>			COURSE SLO to ILO Alignment <i>(Mark with an X)</i>			
	P1	P2	P3	1	2	3	4
ANAT 130 Essentials of Anatomy and Physiology: SLO #1 Language Students will be able to use language appropriate to anatomy and physiology and the health sciences.	X						
ANAT 130 Essentials of Anatomy and Physiology: SLO #2 Instruments Students will demonstrate the use of instruments for dissection, histology, and to gather data.		X			X		
ANAT 130 Essentials of Anatomy and Physiology: SLO #3 Structures Students will be able to identify higher vertebrate body structures, and explain the functions of body systems.			X				
ANAT 132 General Human Anatomy: SLO #1 Language Students will be able to use language appropriate to anatomy and the health sciences.		X					
ANAT 132 General Human Anatomy: SLO #2 Instruments Students will demonstrate the use of instruments for dissection, histology, and to gather data.			X			X	
ANAT 132 General Human Anatomy: SLO #3 Structures Students will be able to identify higher vertebrate body structures of all body systems.			X				
BIOL 100 Fundamentals of Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				X

BIOL 100 Fundamentals of Biology: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X					
BIOL 100 Fundamentals of Biology: SLO #3 Content Knowledge (Mitosis) The student will be able to describe key activities in cell replication.			X				
BIOL 101 Principles of Biology I: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 101 Principles of Biology I: SLO #2 Use of Microscope The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X			X		X
BIOL 101 Principles of Biology I: SLO #3 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.			X				
BIOL 102 Principles of Biology II: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.	X		X				
BIOL 102 Principles of Biology II: SLO #2 Tools The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.		X			X		X
BIOL 102 Principles of Biology II: SLO #3 Content Knowledge (Mitosis) The student will be able to describe key activities in cell replication.			X				

<p>BIOL 115 Environmental Aspects of Biology: SLO #1 Scientific Method The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.</p>	X					
<p>BIOL 115 Environmental Aspects of Biology: SLO #2 Content Knowledge (Energy Flow) Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.</p>			X			
<p>BIOL 115 Environmental Aspects of Biology: SLO #3 Content Knowledge (Materials Cycling) Students will describe how biologically significant materials move between the biotic and abiotic components of an ecosystem and the role living things play in the cycling of these nutrients.</p>						X
<p>MICR 133 General Microbiology: SLO #1 Language Students will be able to use language appropriate to microbiological studies and the health sciences.</p>	X			X		

MICR 133 General Microbiology: SLO #2 Instruments Students will demonstrate the use of instruments to gather data.		X					
MICR 133 General Microbiology: SLO #3 Microbes Student will be able to identify microbes and explain their roles in health and disease.			X				
PHYO 131 Human Physiology: SLO #1 Language Students will be able to use language appropriate to physiological functions and the health sciences.	X						
PHYO 131 Human Physiology: SLO #2 Instruments Students will demonstrate the use of instruments to gather physiological data.		X			X		
PHYO 131 Human Physiology: SLO #3 Mechanisms Students will be able to describe mechanisms and explain physiological processes that occur in the human body on cellular, organ, systemic, and organismal levels.			X				

b) Timeline for Course and Program Level SLO Assessments

COURSE SLO ASSESSMENT 4-YEAR TIMELINE REPORT					
Assessment Cycle	Course ID	Course Name	Course SLO	Title	Course SLO Statement
2019-20 (Spring 2020)	ANAT 130	<i>Essentials Anatomy/ Physiology</i>	SLO #3	Structures	Students will be able to identify higher vertebrate body structures, and explain the functions of body systems.
2019-20 (Spring 2020)	ANAT 132	<i>General Human Anatomy</i>	SLO #3	Structures	Students will be able to identify higher vertebrate body structures of all body systems.
2019-20 (Spring 2020)	MICR 133	<i>General Microbiology</i>	SLO #3	Microbes	Student will be able to identify microbes and explain their roles in health and disease.

2019-20 (Spring 2020)	BIOL 100	<i>Fundamentals of Biology</i>	SLO #1	Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
2019-20 (Spring 20120)	BIOL 115	<i>Environmental Aspects of Biology</i>	SLO #1	Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
2019-20 (Spring 2020)	PHYO 131	<i>Human Physiology</i>	SLO #3	Mechanisms	Students will be able to describe mechanisms and explain physiological processes that occur in the human body on cellular, organ, systemic, and organismal levels.
2020-21 (Spring 2021)	ANAT 130	<i>Essentials Anatomy/ Physiology</i>	SLO #1	Language	Students will be able to use language appropriate to anatomy and physiology and the health sciences.
2020-21 (Spring 21)	ANAT 132	<i>General Human Anatomy</i>	SLO #1	Language	Students will be able to use language appropriate to anatomy and the health sciences.
2020-21 (Spring 2021)	MICR 133	<i>General Microbiology</i>	SLO #1	Language	Students will be able to use language appropriate to microbiological studies and the health sciences.
2020-21 (Spring 2021)	PHYO 131	<i>Human Physiology</i>	SLO #1	Language	Students will be able to use language appropriate to physiological functions and the health sciences.
2020-21 (Spring 2021)	BIOL 100	<i>Fundamentals of Biology</i>	SLO #2	Tools	The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.

2020-21 (Spring 2021)	BIOL 101	<i>Principles of Biology I</i>	SLO #1	Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
2020-21 (Spring 2021)	BIOL 101	<i>Principles of Biology I</i>	SLO #2	Use of Microscope	The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.
2020-21 (Spring 2021)	BIOL 101	<i>Principles of Biology I</i>	SLO #3	Content Knowledge (Energy Flow)	Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.
2020-21 (Spring 2021)	BIOL 115	<i>Environmental Aspects of Biology</i>	SLO #3	Content Knowledge (Materials Cycling)	Students will describe how biologically significant materials move between the biotic and abiotic components of an ecosystem and the role living things play in the cycling of these nutrients.
2021-22 (Fall 2022)	BIOL 102	<i>Principles of Biology II</i>	SLO #1	Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
2021-22 (Fall 2022)	BIOL 102	<i>Principles of Biology II</i>	SLO #2	Tools	The student will be able to use the compound and dissecting microscope to observe cells and microorganisms.
2021-22 (Fall 2022)	BIOL 102	<i>Principles of Biology II</i>	SLO #3	Content Knowledge (Mitosis)	The student will be able to describe key activities in cell replication.

2021-22 (Spring 2022)	ANAT 130	<i>Essentials Anatomy/ Physiology</i>	SLO #2	Instruments	Students will demonstrate the use of instruments for dissection, histology, and to gather data.
2021-22 (Spring 2022)	ANAT 132	<i>General Human Anatomy</i>	SLO #2	Instruments	Students will demonstrate the use of instruments for dissection, histology, and to gather data.
2021-22 (Spring 2022)	MICR 133	<i>General Microbiology</i>	SLO #2	Instruments	Students will demonstrate the use of instruments to gather data.
2021-22 (Spring 2022)	PHYO 131	<i>Human Physiology</i>	SLO #2	Instruments	Students will demonstrate the use of instruments to gather physiological data.
2021-22 (Spring 2022)	BIOL 100	<i>Fundamentals of Biology</i>	SLO #3	Content Knowledge (Mitosis)	The student will be able to describe key activities at each stage of mitosis.
2021-22 (Spring 2022)	BIOL 115	<i>Environmental Aspects of Biology</i>	SLO #2	Content Knowledge (Energy Flow)	Students will use basic energy principles to explain the flow of energy in living systems, such as those that occur in the cellular metabolic pathways of photosynthesis and cell respiration, or the relationships observed between autotrophs and heterotrophs in ecosystems.

PLO ASSESSMENT 4-YEAR TIMELINE REPORT			
Assessment Cycle	Unit Name	PLO Name	Course PLO Statement
2019-20 (Spring 2020)	Life Science: (Anatomy, Biology, Physiology, Microbiology)	PLO #3 Application of Health Science Concepts	Students will be able to apply concepts learned to healthy and pathological outcomes.
2020-21 (Spring 2021)	Life Science: (Anatomy, Biology, Physiology, Microbiology)	PLO #1 Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.
2021-22 (Spring 2022)	Life Science: (Anatomy, Biology, Physiology, Microbiology)	PLO #2 Biological Methods	The student will master the use of appropriate biological tools and evaluate evidence gathered to explain biological principles.
2022-23 (Spring 2023)	Life Science: (Anatomy, Biology, Physiology, Microbiology)	PLO #3 Language and Concepts	Students will be able to use language and apply concepts learned to the life sciences.
2023-24 (Spring 2024)	Life Science: (Anatomy, Biology, Physiology, Microbiology)	PLO #1 Scientific Method	The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence.

c) Percent of Course and Program SLO Statements that have been Assessed

For both the course and program level SLO statements have been assessed each year. The assessments that have not been completed during that time period are due to be assessed in the next year. Moreover, certain courses with a low percentage of assessed SLO statements such as Biology 15: (Environmental Aspects of Biology) are only offered intermittently. Finally, our program has implemented better practices to encourage part-time faculty to complete their SLO assessments in a timely manner including assigning a full-time faculty member as the lead faculty to oversee the data collection, interpretation, and submission into the Nuventive system.

d) Summarization of the SLO and PLO Assessment Results

SLO assessments completed in Life Sciences gave valuable information which is helping faculty to:

1. Understand how to better facilitate student learning.
2. Determine what's working and what's not working in their courses or program.
3. Select the appropriate teaching strategy.
4. Prioritize the need for equipment and technology to improve instructions.
5. Help students to explain what they can do and what they know.

As a result of SLO assessments and reports, the faculty is continuously updating their pedagogy, acquiring new strategies, and improving student/professor relationships. On the average, most of our students succeed in the individual SLO assessments conducted. The Life Science program assessed and completed with expected results of the SLO reports that are due. We strongly believe that inadequate student preparation in reading skills, requisite background knowledge, time management skills, and taking too many classes in a semester contributes to their lack of success.

e) Improvement of SLO Process and Dialogue about Assessment Results

Each course is assigned to a full-time faculty coordinator, who is responsible to discuss SLO tools, rubrics, results, and then find ways to further improve the outcomes. Each instructor provides their results and gives input on how the course /program can be improved. It is common knowledge that many of our students become overwhelmed and frustrated by mid- semester because of the amount of material that has to be covered in each of our courses. It is recommended that assessments are done close to the time the material was taught to have a good idea if students understood the materials when taught. If time permits, we may conduct another assessment any other time before the end of the semester.

f) Findings from SLO/PLO Assessments

The plan is to spend enough time on each topic covered in and out of the classrooms. We need more tutoring, supplemental instruction, and open labs for students in the program. Proper student academic program planning by the Counseling Program will ensure that students who need to, take classes that teach reading and study skills before enrolling in Life Science classes. We also have requested projection microscopes and specially advanced technology for Biology 100, 101, and 102. It is believed to provide microscopes with pointers to increase student's success outcomes.

We strongly believe that inadequate student preparation in reading skills, requisite background knowledge, time management skills, and taking too many classes in a semester contributes to decrease their success.

g) List any related recommendations.

1. All sections of a course should have similar SLO/PLO assessment tool, rubric and faculty complete within a mutually agreed time frame.
2. The data should be forwarded to the course coordinators.
3. The assessed report discussed by the faculty to suggest any changes in teaching strategies to improve the results.
4. Encourage the availability of enough tutoring for all students.
5. SI coaches could be assigned to sections reporting issues with success and retention.
6. All weekly lab schedules be uniform in all sections of a courses and lab scheduling to be well aligned with lectures.

5. Analysis of Student Feedback

This survey gathers the perspectives of Compton Center students in Life Science program during the Fall 2015 semester. Responses were sought on several issues that influence student satisfaction, such as the classroom environment, quality of instructors, courses offered and their availability, and the quality and availability of facilities.

The number (N) of students surveyed was 149. Not all the students responded to all the 15 statements in the survey. Areas covered were:

- Student Support
- Curriculum
- Facilities, Equipment, and Technology
- Program Objectives

a) Description of the Results of the Student Survey

The survey results for each aspect/statement as indicated before, are presented at the end of this write up but are summarized below under the four areas.

i. Student Support

As evident from the table below, students view the instructors in Natural Sciences Program very favorably. The majority of students also appreciate the sense of community within the program, and feel that their contributions are appreciated. However, a good number of students are neutral on these two aspects. As all of the students at a community college are commuters and return home after their classes are done for the day, it can be particularly challenging for them to develop a sense of community.

Student Support		Scale	1	2	3	4	5	--	--
		Frequency	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Missing	Mean
1	Instructors in this program have helped me achieve my academic goals	67	64	13	3	0	2	1.67	
2	Instructors in this program have helped me stay on track.	73	62	10	3	0	1	1.61	
3	Instructors in this program provide opportunities to actively participate in my classes.	73	62	8	2	0	4	1.58	
4	I have felt a sense of community within this program.	54	69	24	1	0	1	1.81	
5	Student contributions have been valued by instructors in this program.	61	64	21	0	0	3	1.73	

ii. **Curriculum**

The feedback from the survey is positive. The only exceptions are regarding the variety of extracurricular activities available and adequacy of library resources, which may need some improvement.

Curriculum		Scale	1	2	3	4	5		
		Frequency	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Missing	Mean
1	There is an appropriate range of courses offered in this program.	61	73	8	6	0	1	1.72	
2	Courses were scheduled on days and times that were convenient to me.	64	68	14	2	0	1	1.69	
3	I've been able to register for the classes I need within this program.	72	63	6	7	0	1	1.65	
4	The courses in this program have helped me meet my academic goals.	67	69	10	1	0	2	1.63	
5	There is a variety of extracurricular activities related to this program on campus.	32	44	58	9	3	3	2.36	
6	The library has the resources to help me succeed in this program.	46	49	49	4	0	1	2.07	

iii. **Facilities, Equipment, and Technology**

Even though two-thirds of the students have positive feedback on the available facilities, equipment and technology, one third of the students think otherwise. Our faculty are working with maintenance staff to improve the cleanliness of the building and improve issues with facilities.

Facilities, Equipment, & Technology		Scale	1	2	3	4	5		
		Percent	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Missing	Mean
	The buildings and classrooms used by this program are satisfactory.	30	70	21	23	2	3	2.29	
	I am satisfied with the equipment (projectors, machinery, models, etc.) used in this program.	39	65	29	12	2	2	2.14	
	I am satisfied with the computers and software used in this program.	37	62	43	4	1	2	2.12	

iv. Program Objectives

The survey results on the program objectives are positive.

Program Objectives	Scale	1	2	3	4	5		
	Percent	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Missing	Mean
I am aware of the course outcomes - what I should be able to learn and what skills I should possess after completing courses in the program.	73	70	3	0	0	3	1.52	

b) Implications of the Survey Results for the Program

In general, most of the survey results are very positive. Most students appreciate the sense of community within the program and feel that their contribution are appreciated. However, about 15% of students do not have positive feedback and are neutral on these two aspects. The variety of extracurricular activities available and adequacy of library resources did not elicit positive feedback from a significant number of students and will need some improvement. One third of the students had a neutral or negative feedback on availability and adequacy of facilities, equipment, and technology in the program.

c) List any Related Recommendations

To develop a sense of community and appreciation of their contributions, all the students should be encouraged to take part in class and extracurricular activities and their success should be praised regularly. About 50% of students feel that the extracurricular activities related to the program are inadequate. Students may be too busy working and may have very little spare time or only a little time in between classes to know what actually exists on campus. Facilities should be provided for small group/short time extracurricular activities.

About 30% of students considered the Library resources inadequate. It is recommended that the library should have at least three (3) sets of textbooks and Lab manuals available to help students who cannot afford to buy them. The Library should subscribe and provide students free access to online/hard copy science and other relevant journals. A third of the students surveyed considered facilities, equipment, and technology inadequate. These need to be assessed in detail and improvements should be made where essential. Some of the immediate attention needed in our facilities, equipment and technology the Math Science building air conditioning, maintenance of clean class rooms and bath rooms, availability of models, specimens, at least two microscopes with attached cameras, and relevant software in the labs.

6. Facilities and Equipment

a) Description and Assessment of the Existing Program Facilities and Equipment

Facilities

In the Life Science program, the facilities and equipment are just adequate for the current size of the program, but in need of improvements and expansion to support increase in enrollment in the program. Due to limited availability of classrooms, the growth of the program through introduction of additional sections or new courses is limited. Our classes are scheduled back to back Monday through Friday and in the morning, afternoon, and evening. Currently, there are 6 classrooms which are dedicated to Biology (MS 108), Anatomy (MS 105, 110, and 128), Physiology (MS 103), and Microbiology (107). Furthermore, the scheduling of additional anatomy, physiology, and microbiology is difficult with current laboratory space, so adding more laboratory space is critical for expansion. The program also has two laboratory preparation areas (MS 109 and 106) which are configured as biology and microbiology preparation rooms besides serving as storage space for anatomy and physiology materials. A highly functional cold room (MS 104) serves to preserve dissection animals and organs.

Equipment

Recently, the program purchased 80 new microscopes for Microbiology and Biology classrooms. The previous microscopes were repaired and placed in the Anatomy and Physiology classrooms. Physiology increased the amount of BIOPAC units from four to seven and additional units of models have been added for the Anatomy and Biology classes. The addition of comfortable laboratory chairs has facilitated learning in the classroom.

b) Immediate (1-2 years) Needs Related to Facilities and Equipment

The immediate need of the Life Science program is the regular maintenance of its equipment and facilities. We need every one of our resources to function all the time and continue to support the vast amount of instruction going on in the program. Any loss or damage to our equipment or facilities will negatively impact the program. The Life Science program will not be able to keep the enrollment and success numbers because what we have now is just adequate. There are no backup equipment, models, and even space. Regular janitorial service for the classrooms, bathrooms, and offices is much needed. Faculty members work tirelessly to retain students beyond one semester in the program but many first time students have expressed disappointment over the aesthetic value of the Math Science building, inside and outside. An alarm system in the cold room (MS 104) that can sound when the door is not closed properly or the temperature changes quickly, will help to properly preserve the dissection specimens. We need an additional lab in order to offer biotechnology courses and to accommodate the equipment that we have purchased such as MS 105.

c) Long-range (3-4 years) Needs Related to Facilities and Equipment

Our planning will continue to focus on the educational needs of students. The health care industry is projecting a shortage of qualified personnel needed to care for an aging population and also that the older current healthcare workers are retiring. There is a great demand for healthcare-related services; therefore, our program needs to anticipate more students entering health and science careers. Our program can invest in higher quality, more efficient facilities both lecture and laboratory settings. MS 105 and 128 need to be restructured to accommodate

both lecture and lab classes and could also potentially accommodate biotechnology lab-based courses. Additional space for classrooms is needed to maximize the sections offered and allow. Additionally, the seating arrangement in the Anatomy lab (MS 110) needs to be reconfigured so that all students face the instructor and the board in the front of the classroom. A more modular configuration in which laboratory benches are on wheels and can be rearranged may provide the ultimate flexibility to transition from lecture where students face the instructor to group work in which students turn their laboratory benches to face their fellow students.

d) List any Related Recommendations (short and long term)

Retro-fitting of existing classrooms & labs for gas supply is vital to providing a safe, efficient place for students to learn. The Life Science program proposes facility repairs or modifications for the coming years. Our needs regarding facilities and equipment are listed in Prioritized recommendations on facilities & miscellaneous table, which includes chemicals, models, and equipment cost.

Concerning the adequacy and currency of facilities & equipment, the department recommends the repair of electrical outlets on MS 103, 105, 107, 108, 128, and 110. The floors have electric outlets with plastic covers where a few areas are not safe to walk. Additionally, the fume hoods in MS 106 and 108 need to be repaired as it is a safety issue. The building and the classrooms used by the program are rated by our students as satisfactory. 20.13% of the respondents strongly agreed, 46.98% agreed, and 14.09% neither agreed nor disagreed with the statement. Also, the data collected on students' satisfaction with the equipment used in the program showed 26.17% strongly agreed, 43.62% agreed, while 19.46% neither agreed nor disagreed.

The immediate (1-2 years) needs related to the facilities and equipment:

- i. Repair of plumbing and electrical lines in the classrooms to keep students, faculty, and staff safe.
- ii. Annual servicing of microscopes, fume hoods, and the autoclave are very important so that students, faculty, and staff have access to properly functioning equipment in the laboratory. In particular, the microscopes in the Anatomy lab (MS 110) need pointers added to the eyepiece so that Instructors can more effectively convey to students which structure(s) on a given slide to focus on.
- iii. Waste disposal of used reagents and dissection specimens needs to be regularly scheduled for the waste to be safely discarded. The use of these materials ensures that students get adequate hands on training with live cultures or actual specimens to dissect for a deeper understanding of the materials.
- iv. The Annual Natural Science Student Research Symposium is an important means to showcase the learning that is taking place within our program. Student-led research is a proven high impact learning method for students. Funding for reagents and supplies for the research as well as awards and refreshments for the ceremony are thus requested.

- v. Many of the door stops are nonfunctional and faculty prop open doors by placing a desk or chair in the doorway, which partially blocks the exit and poses a hazard in the event of an emergency escape. Additionally, the doors in the back of classrooms MS 108 and MS 110 are not able to be locked from the inside, which is a safety hazard in the event of a danger outside of the classroom such as an active shooter or some other human threat.

Long-range (2-4 years) needs related to the facilities and equipment

At least two extra laboratory and classroom spaces are needed to facilitate a more relaxed scheduling of our classes and to increase enrollment in all courses taught in the program. The total cost estimate depends the number of spaces structured. The program expansion will take place only with additional spaces to increase the number of those courses. Finally, a human cadaver would be more relevant than cats for dissection, particularly for students that are interested in pursuing health care careers.

Recommendations on facilities & miscellaneous

Categories	Items
Miscellaneous	Microscope repair, parts, and service
Miscellaneous	Other equipment repair and service contract (autoclave, fume hoods, etc.)
Miscellaneous	Purchasing consumable reagents, models, and dissection specimens (cats, brain, eyes, hearts, etc.)
Miscellaneous	Waste disposal fees (dissection specimens and chemicals disposal)
Educational	Providing funds for Science Student Research Symposium
Facility	Repair sinks and install garbage disposals, repair door stoppings and locks, add lock block to MS 108 and 106
Facility	Installing alarm system for cold room door (MS 104)
Facility	Repair and certification of fume hood (MS 109)
Facility	Remodel MS105 to accommodate biotechnology equipment
Miscellaneous	Purchase equipment for microbiology (staining jars, antibiotic disk dispensers, etc.) and biotechnology (balances, pH meters, etc.)

7. Technology and Software

a) **Description and Assessment of the Existing Program Facilities and Equipment**

The classrooms in Life Science program were recently upgraded with audio-visual (AV) technology system that includes projectors, screens, computers, with windows 10 and Utology software login setup. In human physiology lab, BIOPAK software has been installed on several

laptops to be used to conduct laboratory exercises on muscle, brain, heart, and lung functions during lab activities.

The availability of campus-wide Wi-Fi technology is a great provision that allows instructors and students access to the Internet at anytime and anywhere on campus, especially in the classroom for both lecture and lab activities. The availability of the Wi-Fi service on campus has opened limitless academic resources and possibility to incorporate technology that promote students' ownership of knowledge and increased responsibility for their learning

b) Immediate (1-2 years) Needs Related to Technology and Software

Taking into consideration that there has been a drop in the overall college enrollment, we suggest improving infrastructure and technology to attract and sustain student enrollment. Using technology and hands-on training in Life Science program would enhance the employment and career opportunities for our students. Advanced technology could be incorporated by using interactive audiovisual assistants such as:

1. ECG machine

Approximate cost: \$2000 for the machine

Recording paper \$5/pack

Maintenance \$100/each repair

2. Desktop Spirometer

Approximate cost: \$2000 for the machine

Recording paper \$5/pack

Maintenance \$100/each repair

3. EEG machine with Bluetooth function (40 individual machine, \$50 each) the portable device can measure Glucose meter, Thermometer, Urine analyzer, scale, etc.

4. Digital Professional Trinocular Compound Microscope 40X with camera connection to the AV system

Approximate cost: \$3000

Maintenance /extended warrantee \$600

5. Procuring access to Lynda.com for faculty and staff. This is a website that teaches the latest software, creative, and business skills through high-quality online instructional videos featuring recognized industry experts.

6. The current lighting situation in room MS 128 needs to be fixed ASAP to allow proper usage of the projector. The problem presents itself especially at night when the lights above the projection screen cannot be turned off or dimmed. When the lights are on, it becomes hard for students to see what is projected on the screen and when the light are off, the students are in complete darkness and cannot see what is on their desks and therefore cannot read their texts or write down notes.

c) Long-range (2-4+ years) Needs Related to Technology and Software

Our planning continues to focus on industry and educational needs of students. One way to attract and increase student enrollment is using computers in classrooms. Providing laptops for students in the classroom for examination, laboratory exercises, survey, and practice in classroom, not only would save time, efforts, and costs compared to the traditional non-computer classroom settings, and promote quality education among our students.

1. Each classroom would need about 40 laptops (Approximate cost \$600/each)
2. Laptop Software:
 - Online examination, survey, evaluation that is linked to Canvas (our course management system)
 - Essential Anatomy 5 (\$25)
 - Sobotta atlas (\$70)
 - Skeletal system -3D atlas of anatomy (\$10)
 - Free apps for brain and other organs/systems lab activities
3. Offering hybrid classes that incorporate both the traditional classroom and online education would benefit a vast majority of our students who have limited availability for onsite classes.
4. Access to Canvas needs to be made available again to faculty that teach face-to-face classes and who wish to use this platform as a resource for their classes.

d) List any Related Recommendations

New technology and its applications in science and in the classroom in particular have revolutionized every aspect of the teaching/learning process. The use of audiovisual-based technology in the classroom not only promotes active learning in the classroom, but also enhances students' attentions, understanding, retaining and applying the course materials. To better prepare college students of the 21st century, the science education reforms recommended that science teachers should integrate technology and inquiry-based teaching into their instruction (American Association for the Advancement of Science, 1993; National Research Council [NRC], 1996, 2000). Health science majors would benefit tremendously from hands on practice using medical devices alongside BIOPAK software that teaches the basics underlying the medical devices.

The purchasing and installation of high-tech hardware and software in classrooms could be financially costly, but in the long term it is money well spent economically and environmentally. For example, using the laptops for online examination/surveying to replace the traditional hard copies is convenient and would cut extensive costs of papers, printing, labor, and most importantly has environmental benefits to save our ecosystem and cut our ecological footprint. Even with a single computer connected to a projector screen, an Internet

connection and a microscope, instructors can demonstrate the histology and microbiology slides as resources for engaging students and helping them learn science concepts. In short, the search for up-to-date affordable technology and equipment in science should be continued as well as providing the essential training for faculty to better serve their students and provide quality education. If Canvas LMS cannot be provided in the short term, then training session on how to use alternative tools such as Google Drive could be arranged for faculty to help with this situation during the transition period.

8. Staffing

a) Current Staffing

The Life Sciences program has seven full-time faculty members and many part-time faculty members. All faculty members of the program are well-qualified and have advanced degrees. There has been considerable transition among the faculty over the past 3 years with the promotion of some members and the resigning of others. Four of the full-time faculty members were hired within the last 5 years. The hiring of the three new full-time Anatomy/Physiology Instructors in Fall of 2016 was essential as enrollment in anatomy and physiology courses in particular has been increasing (see Program Participation section). Moreover, only 33% of the Anatomy 30: Essentials of Anatomy/Physiology sections and 45% of the Anatomy 32: General Human Anatomy were taught by full-time faculty during the Fall 2015 semester, in contrast with 60-100% of sections that were taught by full-time faculty for the other courses offered in the program.

Our program was able to increase the ratio of full-time to part-time faculty teaching these in-demand courses to retain students and help them succeed. The program has two full-time laboratory technicians who are responsible for ordering supplies, preparing the materials, and setting up the labs. Our program also has one hourly student worker to assist our laboratory technicians. A limited number of courses in the program have Supplemental Instruction (SI) coaches including Biology 100, but there is no dedicated tutor available for all of the courses in the Life Science program. The Life Science program is part of the STEM Guided Pathway Division which is overseen by one division chair and one dean.

b) Program's Immediate (1-2 years) and Long-range (2-4+ years) Staffing Needs

The program's most immediate need is for dedicated tutors and additional Supplemental Instruction (SI) coaches to cover more courses. Academic support services like tutoring and supplemental instruction are a well-established means of improving success, retention, and persistence. Additionally, tutors and SI coaches can close the equity gap for underprepared students. SI coaches in particular are trained to provide students with study skills and develop their sense of self-efficacy. The associated salary cost of hiring tutors or SI coaches for 20 hours/week to be available during various times of the day as well as the evening would be \$10,000-\$13,500 per year.

c) Related Recommendations

Tutors and SI coaches need to be hired for 20 hours/week to improve student success rates. Additional staff and faculty hires in the next 2-5 years will be dependent on the FTES generated by the program.

9. Direction and Vision

a. The Comprehensive Master Plan as well as the Strategic Initiatives (SI) continue to be our guide as we look into the future. Our main focus is better instruction and student support for improved student retention and success. The faculty pledge to continue to improve themselves through student and faculty assessment, training, and planning.

Advances in biotechnology, needs in the health care industry, and the federal science goals require the program to keep pace with industry demands. In order to accomplish this goal, the program will focus on continued updates to lecture/laboratory equipment and laboratory spaces. Our lack of expanded laboratory space places a limit on the number of course sections that were offered and limited the number of students that could be educated to meet industry and university demand.

The life sciences are a dynamic field which has seen many breakthroughs in recent years. The discovery of CRISPR for genome editing is revolutionizing scientific research and medicine. Immunotherapy such as CAR T-cell therapy has shown great promise in treating cancer. Likewise, stem cells show potential to treat numerous diseases. We are at the precipice of making leaps and bounds forward with treating diseases which were previously incurable. Therefore, we urgently need a skilled workforce in the life science industry to research and produce these therapeutics as well as knowledgeable health care workers to administer them.

b. Hence, we propose a new biotechnology program which would train students how to work in a lab or biomanufacturing facility which produces pharmaceuticals, cosmetics, etc. Students could learn techniques and principles applied in a biomanufacturing setting at our college in order to earn a certificate in biomanufacturing. The supply of middle skill workforce-ready students in biosciences or biomanufacturing is not currently meeting demand for projected job openings in the Los Angeles/Orange County region. The shortage of students supplied to the regional labor market may be as many as 98 per year, with 276 annual openings and 178 job-ready candidates. We are designing our program with the realization that not all students enrolled in training may want to immediately transition as work-ready, opting instead for transfer to a university to continue their education and progress into jobs at a higher than middle skill level so we are designing transferable courses.

The student population at Compton College is made up of many groups that are underrepresented in the STEM field and our goal is to reverse those trends by supporting underrepresented students to be successful in their life science courses. Active learning approaches in general have been shown to increase learning gains across the board for students, but they also help close the equity gap because students with backgrounds underrepresented in STEM show disproportionate learning gains compared to their peers (Scott Freeman et al. PNAS 2014;111:23:8410-8415). The STEM pipeline is a leaky one and the students that we are losing tend to be first generation students and underrepresented minorities. Hence, active learning approaches such as the one that I am proposing will support the retention and persistence of the target equity populations of students, thus diversifying the field of science.

c. Our program needs expanded and more collaborative laboratory spaces to accommodate additional course offerings. Additionally, our program needs to develop more online and hybrid course offerings which could potentially increase our FTES by attracting more students who are

seeking a flexible schedule. These online and hybrid courses are expected to not only increase enrollment because of their appeal to students, but would also free up classroom space to accommodate more section offerings. We recommend purchasing equipment and supplies used in the biomanufacturing industry (balances, pipette sets, reagents and consumables, etc.).

In terms of revolutionizing our teaching to use backwards design and high impact practices like active learning, we recommend an interdisciplinary Faculty Learning Community in which speakers would teach faculty about effective teaching. A few faculty members would develop model lessons based on published work to the faculty members in their discipline (e.g. contextualized math, project-based learning, etc).

10. a. Prioritized Recommendations

Recommendations	Cost Estimate	Strategic Initiatives
1. Repair sinks (MS 103, 109, 128, 108, and 129) and install garbage disposals and strainers in those lab drains	\$4,000	2.1
2. Purchase 6 Electric Micro-sterilizers	\$ 2,217	1.1
3. Purchase 10 Elmo document cameras	\$7000	1.1, 1.3, 2.1
4. Purchase 2 sagittal skull models	\$3,400	1.1, 1.3, 2.1
5. Purchase 1 skeleton/bone box	\$1,000	1.1, 1.3, 2.1
6. Purchase 64 coplin staining glass jars	\$898	1.1, 1.3, 2.1
7. Install pointer on all anatomy microscopes	\$500	1.1, 1.3, 2.1
8. Purchase 2 automatic antibiotic dispenser	\$1,485	1.1, 1.3, 2.1
9. Install hand dryers in the bathrooms	\$1,000	2.1
10. Change air filters in all classrooms and repair heat/air conditioning in MS 108	\$1,000	2.1
11. Purchase a dishwasher	\$500	2.1
12. Purchase a male and a female cycad to plant on campus	\$250	1.1, 1.3, 2.1
13. Purchase projector bulbs and office supplies	\$500	2.1
14. Hire tutors and SI coaches	\$10,000- \$13,500/yr	1.1, 1.3, 2.1, 2.2
15. Fund Annual Student Research Symposium	\$5,000/yr	1.1, 1.3, 2.1
16. Purchase 6 microscopes with camera and connection to AV system	\$5,400	1.1, 1.3, 2.1
17. Repair door stoppings and locks, add lock block to MS 108 and 106	\$5,000	2.1
18. Install alarm system for cold room door (MS 104)	\$1,000	2.1
19. Purchase Lynda.com	\$25/month	1.1, 1.3, 2.1
20. Turn off always-on light in MS 128	\$100	2.1
21. Purchase 40 laptops/classroom (5) plus software	\$128,400	1.1, 1.3, 2.1
22. Purchase 8 Troemner™ Stainless Steel Class 7 Weight Sets	\$696	1.1
23. Purchase 8 Ohaus™ Navigator™ NV621 Balances	\$1,968	1.1
24. Purchase 8 Fisherbrand™ Bacti-Loop™ Micro-Sterilizers	\$3,167.60	1.1
25. Purchase biotechnology reagents and consumables	\$5,000	1.1
26. Purchase 8 Fisherbrand™ accumet™ AE150 Benchtop pH	\$4,100	1.1

Meters		
27. Purchase 4 Fisher Science Education™ Precision Balance with Draftshield	\$5,760	1.1
28. Purchase 1 71 L Corning™ LSE™ Shaking Incubator	\$6,360	1.1
29. Purchase 2 Classroom Pipette Sets	\$8,398	1.1
30. Purchase YSI 2500 Biochemistry Analyzer	\$21,850	1.1
31. Microscope repair, parts, and service	\$12,000/yr	2.1
32. Purchase dissection specimens and other consumables	\$15,000	1.1, 1.3, 2.1
33. Hazardous waste disposal (e.g. dissected specimens)	\$3,000/yr	2.1
34. Autoclave repair and service contract	\$10,000	2.1
35. Purchase 40 iPads/laptops plus software for student use	\$25,000	1.1, 1.3, 2.1
36. Annual certification of hood (MS 106 and 109)	\$500/yr	2.1
37. Purchase ECG machine, EEG machine, Document camera, and Spirometer	\$7,000	1.1, 1.3, 2.1
38. Purchase human cadaver, gurney, and related supplies	\$6,500	1.1, 1.3, 2.1
39. 10% release time for one semester for faculty to write an NSF S-STEM proposal	\$4,800	1.1, 1.3, 2.1
40. Remodel MS 105 to accommodate biomanufacturing equipment	\$136,102.4	1.1
41. Establish Faculty Learning Community and bring in speakers	\$3,000	1.4
42. Purchase three sets of textbooks and lab manuals for every course available in the library and subscriptions to online/hard copy science and other relevant journals	\$4,000	1.1, 1.3, 2.1

b) Explanation of Prioritization

Having facilities and equipment in good, working order conveys to students that our program is delivering a worthwhile, high quality educational experience which will potentially help our program retain a higher percentage of students. The repair of plumbing issues is such a basic need that should be addressed immediately in order to prevent the problem from getting worse. It's not realistic to keep all solids out of the sinks when cleaning up after doing dissections, for example. Therefore, garbage disposals would help to ensure that the drains don't get clogged, thus saving the department money in the long run. Micro-sterilizers are essential as there are no gas lines in the microbiology prep room to run Bunsen burners. From a safety point of view, these electric micro-sterilizers are safer during earthquakes than additional gas lines. Document cameras are another essential piece of equipment in each classroom in order to effectively show documents or specimens to the entire class.

Beyond the most basic essentials, the priorities were chosen based on their impact and the number of students who would potentially benefit. Sagittal skull models and one additional bone or skeleton box are required for the anatomy courses, which generate many FTES's for our department. Coplin staining glass jar are standardly used in microbiology labs to stain slides, and our microbiology students would benefit from these. The microscopes in anatomy need pointers in the eyepiece for students to show instructors features on their slides and vice versa. The installation of hand dryers in the bathrooms is an environmentally friendly, cost-saving option over paper towels. The bathrooms would be cleaner and the dryers would reduce the burden on the maintenance staff who have to refill the paper towel dispensers. The classrooms need new air

filters and MS 108 does not have heating or air conditioning, which makes it very hard for students to focus on the learning. A dishwasher would help to keep all of the glassware clean. The male and female cycads on campus would be useful to use as a demonstration of a cycad in Biology 101. As MIS does not always carry projector bulbs and the bulbs that they purchase are too weak to see the projected images with lights on in the classroom, the department should buy a few projector bulbs to keep on hand. We also need basic office supplies (markers, erasers, binder clips, staplers, etc.).

The availability of tutors and SI coaches is a well-established way to improve success and retention within a program. Although only a small subset of students in the Life Science program present their research at the Annual Student Research Symposium, many students attend and learn from their peers. A dedicated microscope with a camera that could be set up to the A/V system would be helpful for Instructors to guide students to certain features of the specimen on the microscope slide, particularly for Anatomy students. Repairing the door stoppings and ensuring that all doors can be locked from the inside is a safety issue that needs to be addressed. Installing an alarm system for the cold room door (MS 104) and retrofitting existing laboratory prep rooms with gas availability are equal priorities as they would enhance the functionality of our facilities. Items 22-30 would be used to support a new biotechnology program, which would potentially bring in more students. Microscopes need to be routinely serviced and repaired for optimal instruction as they are very heavily used in every Life Science course. The courses in our program depend on dissection specimens to provide students, many of whom are oriented towards careers in the health sciences, with hands on experience studying various tissues and organ systems. Likewise, the cost to dispose of hazardous materials generated during laboratory exercises is necessary to provide students with authentic, hands on laboratory experiences. The dissection specimens primarily benefit students who are taking Anatomy or Physiology.

A properly functioning autoclave is essential to preparing sterile materials and reagents for our courses, particularly Microbiology. Laptops could potentially support learning by giving students access to information and software while they are in the classroom. The hoods in MS 106 and 109 could be maintained so that they can be used by students, particularly in Biology and Microbiology. Buying an ECG machine, EEG machine and Spirometer is an equal priority with purchasing a human cadaver, gurney, and related supplies. Both of these two priorities would equip our Anatomy and Physiology labs with state-of-the-art equipment bring a higher level of relevance to the learning. The release time for one faculty member to write an NSF S-STEM grant is important to provide scholarships and support services to our students. It would serve to bolster the STEM Center. We need to remove cabinets and benches to make room for large biomanufacturing equipment (e.g. biosafety cabinets, incubators, etc.) in MS 105 for our biomanufacturing program. Moreover, we may need to upgrade the electrical lines to support the equipment. Finally, the funding for the Faculty Learning Community could enhance the quality of teaching in our department and on campus.