PROGRAM REVIEW
NON-MAJORS BIOLOGY

2014-2015

SOLANO
COMMUNITY COLLEGE

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NON-MAJORS BIOLOGY PROGRAM REVIEW

1.1 Introduction. The Biology Department currently serves three distinct student populations: life science majors, non-majors, and pre-allied health. This review focuses on the non-majors component of the program that offers the following lower division general education transfer courses: Environmental Science (BIO 012), Environmental Science Lab (BIO 012L), Introduction to Biology (BIO 015), Human Biology (BIO 016), Human Biology Lab (BIO 016L), Biology of Sex (BIO 018), and Marine Biology (BIO 019). The non-majors biology courses aim to introduce the methods of science as well as fundamentals of biology.

Recent additions to the curriculum include Environmental Science in 1996; Environmental Science Lab in 2001; Marine Biology in 2003; and Human Biology Lab in 2012. A lab manual and student workbook were products of a sabbatical leave of Rennee Moore. Also with the support of a sabbatical leave in 2011, Gene Thomas was able to write a lab manual that is free to students, for Introduction to Biology. Environmental Science and Human Biology are also offered online, that are the only two courses the Biology Department offers in this format.

To promote long-term stability, the Biology Department has hired several full-time faculty members with exclusive or considerable responsibility for non-majors biology courses: Gene Thomas in 1996, Brad Paschal in 2000, and Michelle Smith in 2013. While Rennee Moore was hired for pre-allied health, she has since taken a significant role in Human Biology.

The Biology Department also relies on adjunct faculty to meet scheduling needs. Current (Fall 2014) adjunct faculty members include Rachel Aptekar, Robert Cattolica, Noah Decker, Mike Ensminger, Fereydon Farahnak, Karen Gerhert, Ann Hefner-Gravink, Lori Krueger, Pam Muick, and Linda Staffero.

Lab materials and specimens are prepared/ordered by our lab technicians: Angela Eason (Fairfield), Chris Kucala (Vacaville), and Irene Camins (Vallejo).

1.2 Relationship to College Mission and Strategic Goals. The Biology Department emulates the mission of Solano Community College by serving diverse student populations with various educational goals. The non-majors biology courses are offered to support the college mission of transfer-level education. These courses also strengthen other components of the biology program. For example, pre-allied health students may take Human Biology as it provides an excellent introduction to Human Anatomy (BIO 004) and Introductory Physiology (BIO 005) courses required by nurses, dental hygienists, pharmacists, radiology technicians, sonography technicians, physician assistants and other allied health professionals. Our faculty members are committed to promoting Institutional Learning Outcomes, particularly the ability to communicate effectively and think critically as well as the development of an understanding and appreciation of the natural world.

Table 1. SCC's Strategic Directions and Goals

Goal 1: Foster Excellence in Learning	Program Evidence
Obj. 1.1 Create an environment that is conducive to student learning.	Biology faculty members regularly use classroom technology such as PowerPoint, videos, and animations to enhance understanding for learners of all styles. Laboratory exercises provide opportunities for hands-on learning in a group setting. Many courses (e.g. BIO 012L, BIO 019) include field trips that provide students with a contextual learning experience. The varied techniques and strategies of the biology faculty members provide students with an enriched learning experience.
Obj. 1.2 Create an environment that supports quality teaching.	Faculty members of the biology department are dedicated to student learning as well as professional development. While all biology faculty members participate in Flex Cal activities, some faculty members also serve as presenters. For example, in Spring 2014 and Fall 2014 Brad Paschal and Michelle Smith co-lead a workshop on writing in science courses. Faculty members also participate in external professional development activities such as the Academy for College Excellence (ACE) Five-Day Experiential Learning Institute (FELI) or the Science Education Partnership & Assessment Laboratory (SEPAL) institute. Biology faculty members are dedicated to improving their teaching practices.
Obj. 1.3 Optimize student performance on Institutional Core Competencies	The Biology Program supports three Institutional Learning Outcomes: 1) *Communication A. Read and B Write;* and 2) *Critical Thinking A. Analysis and D. Problem Solving.* Assignments in non-majors biology include problems in genetics, evolution, or solutions to environmental problems; and 3) *Global Awareness, A. Scientific Complexities including the scientific method and how experiments work.* All biology courses

	cover the design of simple experiments, including experimental variables and the use of appropriate controls to evaluate the former. Non-majors biology courses also cover the importance of observational science.
Goal 2: Maximize Student Access & Success	Program Evidence
Obj. 2.1 Identify and provide appropriate support for underprepared students	The non-majors biology courses do not have pre-requisites. Consequently, many students begin these courses unprepared for the challenge. We actively work to support our students. For example, some faculty members provide lists of student services and/or study techniques in the course syllabi. Students may be referred to specific services (e.g. Tutoring Center or the English Lab) for additional support as necessary. Other faculty members provide students with a learning styles inventory at the beginning of the semester. Some faculty promote the use Cornell Notes or similar. Timely referrals to appropriate resources may improve course success rates.
Obj. 2.3 Identify and provide appropriate support for transfer students	The non-majors biology courses can be used to meet IGETC requirements in Biological Science (Area 5B) and/or Laboratory Requirement (Area 5C). For CSU, non-majors biology courses meet Life Science (Area B2) and/or Laboratory Courses (Area B3).
Obj. 2.4 Improve student access to college facilities and services to students	The non-majors biology curriculum includes two courses (BIO 012 and BIO 016) offered in an online format. This format increases the number of course offerings as well as student access to courses. Traditional biology courses often include an e-Companion site that provides course materials online.
Obj. 2.5 Develop and implement an effective Enrollment Management Plan	The biology class schedule is designed to meet the many needs of our diverse students. Non-majors biology courses are

	offered at various times (e.g., day and evening), at multiple locations (e.g., main campus and centers), and in different formats (e.g. lecture/lab or online). The variety of course offerings helps students plan their schedules according to their individual needs.
Goal 3: Strengthen Community Connections	Program Evidence
Obj. 3.1 Respond to community needs	The non-majors biology program supports the community in a variety of ways. For example, BIO 016 prepares students interested in healthcare careers for local programs in nursing, radiology, and sonography.
Obj. 3.2 Expand ties to the community	The non-majors biology program has several continuing connections with the local community. Many of the field-based courses (e.g. BIO 012L, BIO 019) visit local sites including Rockville Park and Rush Ranch. Faculty members encourage students to participate in campus events such as blood drives, Coastal Cleanup Day, and Earth Day. Contributions to these events help students connect with the college as well as the greater community.

1.3 Enrollment. Overall, the total number of non-majors biology sections increased over the past five years (Table 2) despite a temporary decline between Spring 2011 through Spring 2012. The greatest increases in the number of sections were observed in BIO 015 and BIO 016. Other courses maintained the same number of sections (BIO 012L, BIO 018, and BIO 019) while one course (BIO 012) lost sections.

Enrollment count in non-majors biology courses also increased over the past five years (Table 3). This increased enrollment count may be attributed to increases in two courses (BIO 015, BIO 016) as other courses maintained relatively stable enrollment counts over time. Full-Time Equivalent Student (FTES) enrollment also remained relatively stable over the past five years (Table 4) while Weekly Student Contact Hours (WSCH) varied by course (Table 5). For example, some courses (BIO 015, BIO 016) increased in WSCH while other courses (BIO 012, BIO 018, BIO 019) declined in WSCH over time.

Table 2. Number of non-majors biology sections from 2009-2014.

	2009-2010		2010-2011		2011-2012		2012-2013		2013-2014	
	Fall	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*
BIO-012	2	2	2	2	2	2	3	3	2	2
BIO-012L	1	1	2	1	1	1	1	1	1	1
BIO-015	8	7	7	7	7	6	6	10	8	10
BIO-016	7	7	8	6	7	5	9	11	10	11
BIO-016L	-	-	-	-	-	-	-	-	2	2
BIO-018	1	1	1	1	1	0	1	1	1	1
BIO-019	1	1	1	1	1	1	1	1	1	1
TOTAL	**20**	**19**	**21**	**18**	**19**	**15**	**21**	**27**	**25**	**28**

Table 3. Enrollment count of students in non-majors biology courses from 2009-2014.

	2009-2010		2010-2011		2011-2012		2012-2013		2013-2014	
	Fall	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*
BIO-012	85	88	79	86	76	101	101	114	76	84
BIO-012L	22	24	37	31	26	31	19	27	19	24
BIO-015	179	167	162	186	174	161	157	225	170	196
BIO-016	294	333	352	300	346	191	374	412	353	410
BIO-016L	-	-	-	-	-	-	-	-	42	51
BIO-018	53	79	58	61	56	0	49	32	32	32
BIO-019	37	31	34	27	32	25	31	27	20	21
TOTAL	**670**	**722**	**722**	**691**	**710**	**510**	**731**	**837**	**712**	**818**

Table 4. Sum of FTES in non-majors biology courses from 2009-2014.

	2009-2010		2010-2011		2011-2012		2012-2013		2013-2014	
	Fall	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*
BIO-012	9.20	9.60	9.30	9.10	8.10	10.40	10.10	11.40	7.70	8.40
BIO-012L	2.50	2.50	4.00	3.30	3.15	3.85	2.22	3.03	2.22	2.80
BIO-015	40.04	36.40	36.80	39.00	38.02	36.00	31.00	44.40	31.84	39.20
BIO-016	35.80	34.70	40.70	32.60	36.90	23.60	36.71	40.21	34.80	40.80
BIO-016L	-	-	-	-	-	-	-	-	6.30	7.65
BIO-018	5.30	7.90	6.60	6.20	5.60	0	4.90	3.10	3.10	3.20
BIO-019	7.40	6.20	7.20	5.80	6.51	5.00	6.20	5.40	4.00	4.20
TOTAL	**100.24**	**97.30**	**104.60**	**96.00**	**98.28**	**78.85**	**91.13**	**107.54**	**89.96**	**106.25**

Table 5. WSCH in non-majors biology courses from 2009-2014.

	2009-2010		2010-2011		2011-2012		2012-2013		2013-2014	
	Fall	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*
BIO-012	252	264	237	258	228	291	303	342	228	252
BIO-012L	66	72	108	93	91	109	67	91	67	84
BIO-015	1,091	996	966	1,116	1,050	966	930	1,332	955	1,176
BIO-016	990	996	1,050	900	1,035	573	1,101	1,206	1,047	1,215
BIO-016L	-	-	-	-	-	-	-	-	189	230
BIO-018	159	234	171	183	168	0	147	93	93	96
BIO-019	222	186	204	162	195	150	186	162	120	126
TOTAL	**2,780**	**2,748**	**2,736**	**2,712**	**2,767**	**2,089**	**2,734**	**3,226**	**2,699**	**3,179**

While enrollment in non-majors biology courses increased slightly over the past 5 years, total enrollment at the college-level decreased by almost 25% over the same time period (datamart.cccco.edu). Likewise, FTES remained relatively stable over time in non-majors biology courses whereas total FTES for the college declined by over 20% in recent years (datamart.cccco.edu).

1.4 Population Served. The non-majors biology courses are general education transfer-level courses that serve a wide variety of students. The majority of the non-majors biology students are females (5-year average 62.81%) between the ages of 18-25 years old (5-year average 72.38%). Percentage of students by ethnicity changed over the past 5 years with more students identifying a specific category (e.g. white, Hispanic, etc.) rather than indicating "other" (Table 7). Data on enrollment by ethnicity is not available from the previous program review; however, the population served by the non-majors biology courses is comparable to that of the college as a whole (SCC Institutional Data Report, 2013).

Table 6. Non-majors biology students by age groups.

Age Group	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
0-17	5.90%	3.81%	4.52%	3.51%	3.69%
18-25	69.34%	72.84%	73.94%	74.55%	71.21%
26-30	11.69%	10.60%	9.05%	8.93%	10.91%
31-35	5.39%	4.76%	4.32%	5.68%	5.25%
36-40	3.55%	2.86%	3.04%	2.42%	2.94%
41-45	1.72%	2.68%	2.30%	1.85%	2.31%
46+	2.41%	2.44%	2.84%	3.06%	3.64%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Table 7. Non-majors biology students by ethnic categories.

Ethnicity Category	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
A. Indian or Alaskan Native	2.18%	2.68%	3.31%	3.76%	2.89%
Asian or Pacific Islander	17.88%	17.39%	15.73%	19.83%	19.10%
Black, Non-Hispanic	16.79%	15.25%	15.33%	15.82%	17.89%
Hispanic	14.56%	16.74%	17.62%	22.96%	24.93%
Other	19.71%	19.30%	16.68%	6.57%	5.02%
White, Non-Hispanic	28.88%	28.65%	31.33%	31.06%	30.18%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

1.5 Status of Progress toward Goals and Recommendations. Report on the status of goals or recommendations identified in the previous educational master plan and program review.

Table 8. Educational Master Plan

Educational Master Plan		Status
1.	Continue to provide online courses and expand offerings including online labs.	On-going. Two non-majors biology lecture courses (BIO 012, BIO 016) continue to be offered online. An online lab (BIO 016L) is a recent addition to the biology curriculum. Hybrid/online offerings for other biology courses are under consideration.
2.	Expand offerings on the Vacaville and Vallejo campuses.	On-going. Only the high enrollment non-majors biology courses (BIO 015, BIO 016) are offered at all three campuses. Other courses lack sufficient enrollment to justify additional sections. Enrollment numbers continue to be monitored to determine the appropriate number of sections for each of the campuses.

Table 9. Program Review Recommendations

Program Review Recommendations (Previous Cycle)		Status
1.	Hire an additional full-time Biology laboratory technician for the Fairfield Campus.	Incomplete. The main campus requires an additional full-time biology lab technician for laboratory preparation, setup, and breakdown. The new Science Building on the main campus will provide additional lab space requiring the support of two full-time biology lab technicians.
2.	Hire a full-time Biology/Chemistry laboratory technician for the Vacaville Center.	Complete. Christine Kucala was hired as the Science Lab Technician for the Vacaville Center in July, 2011.

3.	Add new laboratories with proper safety equipment as well as technology upgrades.	On-going. A classroom response system, such as the i>clicker system, promotes student engagement with course content while providing faculty with immediate feedback on student comprehension of key concepts. The ultimate objective is to enhance student learning as well as course success rates.

1.6 Future Outlook. The non-majors biology program serves a wide variety of students with a broad range of personal and professional goals. A multitude of factors likely contribute to the steady increases observed in recent enrollment. As the program continues to grow, we need to continue to support our students including student success and faculty support resources as well as equipment and facilities.

While a majority of students (5-year average 56.4%) completed their non-majors biology course with a satisfactory grade (C or higher), a large proportion (5-year average 28.1%) earned an unsatisfactory grade (D or F). This is a cause for concern. We are actively seeking ways to improve student success while maintaining academic rigor. For example, we are working to create writing guidelines for common types of exam questions such as compare-contrast. Students will be provided with organizational tools as well as exemplar student responses. We also plan to collect instructor advice on effective study strategies to create a composite "How to study guide" for students. The student survey conducted in Spring 2014 indicated that 52% of students would like to know more about time management. A corkboard installation in the main campus lab will provide students with information on upcoming Student Success Workshops, including time management skills, available through the college. A collection of student resources will be provided to biology faculty members for distribution to their students and also kept in a centralized location (e.g. library) accessible to all students. The ultimate goal of the development of these student resources is to improve student success rates while maintaining high academic standards.

As student enrollment increases, faculty members also need additional support. Historically, adjunct faculty carried the majority of FTEF (4-year average 40.0% full-time:60.0% part-time) for non-majors biology courses. A recent full-time faculty hire shifted the proportion of FTEF (1-year average 52.3% full-time:47.7% part-time); yet this ratio is still far from the 75% full-time:25% part-time faculty standard. An additional full-time faculty member dedicated to non-majors biology would ensure a high quality educational experience for our students. As student enrollment increases, sections will be added as necessary. Additional sections of lab-based courses (e.g. BIO 015, BIO 016L) require extra lab support; yet many of our lab technicians are already overloaded. The Vacaville Center lab technician is currently split between biology and chemistry; though the new Science Building at the Vacaville Center will provide additional lab space requiring additional support consisting of a full-time biology technician and a full-time

chemistry technician. The new Science Building on the main campus will also provide additional lab space requiring the support of at least two full-time biology lab technicians. Without additional support, faculty will struggle to continue to provide exceptional learning experiences for our students.

The 2013 Facilities Master Plan includes new Science buildings on the main campus as well as the Vacaville Center. This represents a tremendous opportunity for expansion in the sciences while updating technology in the classrooms. To make the most of this opportunity, faculty must be able to contribute to the design of these buildings. For example, we are interested in room sizes to ensure quality educational experiences but also to minimize potential safety issues. Classrooms should include multiple display options (e.g. screens and boards) that faculty may use *simultaneously* to provide students with multi-format presentations. Layouts of lecture rooms must be amenable to multiple teaching strategies while laboratories must have layouts that allow for collaborative learning within small groups. Laboratories must be supplied with quality instructional equipment (e.g. laptops, microscopes) as well as required supplies (e.g. internet connections, electrical outlets). The furnishings and finishes in science laboratories should be durable and reliable including chemical- and stain-resistant surfaces. Laboratories must be supplied with emergency systems including eyewash stations, showers, fire protection, call boxes, and shut-offs. Science courses also require substantial space for preparation and storage of materials. In addition to designated instructional space, many students indicated interest in an Open Lab to receive help with their biology lectures and labs. This suggestion should be given serious consideration for space in the new buildings. All classrooms must be designed to be safe and accessible for all students, staff, and faculty. Without faculty input on building design, key considerations for instructional objectives as well as issues unique to the sciences may be overlooked.

A variety of factors likely contribute to the steady growth observed in the non-majors biology program. To continue to meet the needs of this student body, we are developing resources to improve course success rates while maintaining high academic standards. Faculty members also require additional support including a new full-time faculty member as well as additional lab technicians. The new Science Buildings represent opportunities to expand the science program; however, faculty input on building design is critical to meeting educational goals while addressing safety concerns and equipment needs.

Curriculum Development, Assessment, and Outcomes

Program Level Outcomes

2.1 *Not applicable to non-majors biology*.
2.2 *Not applicable to non-majors biology*.
2.3 *Not applicable to non-majors biology*.
2.4 *Not applicable to non-majors biology*.

Student Learning Outcomes

2.5 The current course outcomes were established when we started the assessment process; they have required few modifications as course objectives were well-established when the courses were first offered. Minor revisions to the course outcomes of BIO 016 were completed to align this course with other biology courses. Specifically, BIO 016 was refocused on the most effective and tangible learning outcomes.

Prior to 2012-13, assessment of student learning outcomes was inconsistent with some faculty assessing all outcomes, some faculty assessing one or two outcomes, and some faculty not participating at all, especially as faculty had lost track of the assessment schedule. Compliance improved in 2012-13 when all outcomes of all courses were to be assessed, and there was greater compliance in 2013-14. Between Fall of 2013 and Spring of 2014, over 96 percent of biology sections were assessed, though the methods and quality of assessments varied considerably. In the future, we will assess all outcomes of all courses twice within the five-year program review cycle as set forth by the Assessment Committee.

As most of the non-majors biology courses have lab components or are lab-based classes, we use student learning outcomes to justify requests for lab equipment through the strategic planning process. To date, we have acquired a new set of dissecting microscopes, an autoclave to prepare materials and more safely dispose of wastes, and a new deionizing water system to prepare solutions. The latter two pieces of equipment are used indirectly by all students in all lab-based courses.

To enhance student success, Rennee Moore has developed a new course (BIO 101) to help students with time management and study strategies. It will meet for eight hours at the beginning of the semester. We think this course will be especially valuable to BIO 016 students who anticipate a pre-allied health major; we hope to offer the first sections in Fall 2015.

Developing common assessments and rubrics began in Fall 2014. We completed one for the scientific method as all the non-majors biology courses include it as part of their curriculum. Discussions on common tools to assess SLOs in courses with multiple sections are ongoing.

2.6 Information related to course outcomes has been reviewed. We expect that methods of assessment will be modified once the common assessments/rubrics are in place for all outcomes.

2.7 Based on analysis of SLOs, instructors have made changes to their courses such as:

- Developing a lab activity on genetics to enhance student understanding of heredity as related to microevolution (BIO 015, SLO 1);
- Developing a template for lab reports to assess student proficiency in graphing and analyzing data as well as drawing appropriate conclusions (BIO 015 SLO 3); and
- Developing an assignment based on concept maps to assess student understanding of oceanographic process as related to marine life (BIO 019, SLO 1).

2.8 Course offerings.

Biology

BIO 012 3.0 Units
Environmental Science
Course Advisory: Eligibility for English 001 and SCC minimum Math standard.
This course examines the basic concepts of biology (especially ecology), chemistry, and physics to study: (1) human population growth, (2) short and long-term use of resources (such as soil, food, land, renewable and nonrenewable energy, water, and air), and (3) the production of pollution and other wastes. Field trips may be required. ***Three hours lecture.***

BIO 012L 1.5 Units
Environmental Science Laboratory
Prerequisite: BIO 012.0 (may be taken concurrently)
Course Advisory: Eligibility for English 001 and SCC minimum Math standard.
A course that uses laboratory and mandatory field trip techniques to examine the ecological roles of organisms, resource use, and pollution/waste. Field trips may be required. ***Three hours lab.***

BIO 015 4.0 Units
Introduction to Biology
Course Advisory: Eligibility for English 001 and SCC minimum Math standard.
A non-majors biology course that introduces basic concepts of living organisms including aspects of biological chemistry, cell structure and function, physiology, genetics, evolution, and ecology. Students must successfully complete both the lecture AND lab portions of the course. Off-campus field trips may be required and may involve a fee. *NOTE: Not open for credit to students who have completed BIO 001, 002 or 012.****Three hours lecture, three hours lab weekly.***

BIO 016 3.0 Units
Introduction to Human Biology
Course Advisory: SCC minimum English and Math standards.
An introduction to general biology with emphasis on the human model. Topics include cell structure and function, human evolution, anatomy and physiology, genetics, and the human impact on the environment. This is a course for non-majors. NOTE: Not open for credit to students who have completed BIO 001, 002, 005, 010 or 015. Three hours lecture. ***Three hours lecture.***

BIO 016L 1.5 Units
Human Biology Laboratory
Prerequisite: BIO 016 with a minimum grade of C (may be taken concurrently).
Course Advisory: Eligibility for English 001 and SCC minimum Math standard.
A non-majors laboratory course providing an introduction to general biology with an emphasis on the human model. Topics include microscopy, cell structure and function, human anatomy and physiology, genetics and the human impact on the environment. ***One half-hour lecture, three hours lab.***

BIO 018 3.0 Units
Biology of Sex
Course Advisory: Eligibility for English 001 and SCC minimum Math standard.
The biological bases of human sex and sexuality will be discussed. Emphasis will be placed on the normal and diseased state of the male and female reproductive system. Essay and objective exams as well as written assignments will be used for student evaluations; the final exam will be comprehensive. ***Three hours lecture.***

BIO 019 4.0 Units
Marine Biology
Course Advisory: Eligibility for ENGL 001 and SCC minimum Math standard.
A non-majors biology course that studies the diversity and natural history of life in the marine environment with an emphasis on the adaptations of organisms to their environment. Students must successfully complete both the lecture and laboratory portions of the course. Field trips may be required. Some field trips may involve a fee. *NOTE: Not open for credit to students who have completed BIO 002 or 003.* ***Three hours lecture, three hours lab.***

Since the last program review, BIO 016L was added to the curriculum so students could have another option to meet their General Education requirements and also to provide a laboratory experience for students contemplating an allied health career. A new course (BIO 101) is in the curriculum process. This course is intended to help students with time management and study skills.

The Department offered a total of 55 sections of the non-majors biology courses in the Spring and Fall 2014 semesters. Thirty-four percent were sections of BIO 015 while 40 percent were sections of BIO 016; these two courses are offered at Fairfield, Vallejo, and Vacaville. The other non-majors biology courses (BIO 012, 012L, 016L, 018, and 019) are not offered at all sites due to less student demand. As a result, BIO 016L and 019 are only offered at Vacaville at this time as the two instructors who teach them, Rennee Moore and Brad Paschal, respectively, are assigned to the Vacaville Center. Several courses (BIO 012, 012L, and 018) are only offered at the Fairfield Campus. Both BIO 012 and 016 are offered online while BIO 016L is offered in a hybrid format. The Biology Department will carefully consider course offerings at the various campuses to enhance efficiency with concern for feasibility and practicality.

2.9 Fill rates/Class size. The fill rates of non-majors biology courses decreased over the last five years (Table 10). This trend is easily explained as the number of sections has increased (Section 1.3) while the enrollment, except for BIO 016, has remained steady (Section 1.3); so the same number of students distributed into more sections results in lowered fill rates. We should be offering fewer sections until enrollment increases.

Table 10. Average fill rates of non-majors biology courses from 2009-2014.

	2009-2010		2010-2011		2011-2012		2012-2013		2013-2014	
	Fall	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*	*Fall*	*Spring*
BIO-012	83.64%	97.96%	86.11%	94.79%	84.38%	108.33%	70.14%	79.17%	80.21%	87.50%
BIO-012L	83.33%	104.17%	66.67%	137.50%	90.00%	137.50%	79.17%	108.33%	79.17%	100.00%
BIO-015	82.08%	86.67%	87.62%	92.86%	90.00%	100.00%	86.11%	74.00%	70.83%	65.33%
BIO-016	84.59%	99.14%	98.07%	108.67%	105.43%	94.40%	82.67%	73.64%	69.60%	74.18%
BIO-016L	-	-	-	-	-	-	-	-	70.00%	85.00%
BIO-018	106.00%	158.00%	101.54%	124.00%	112.00%	0	98.00%	62.00%	62.00%	64.00%
BIO-019	123.33%	103.33%	120.00%	96.67%	106.67%	83.33%	103.33%	90.00%	66.67%	70.00%

We do not have an explanation for the fluctuation in fill rates over the last five years, especially for BIO 012L. If we are to maintain effective contact with students, we do not anticipate changing class maxima for BIO 015, 016L, or 019. Although, we could increase the enrollment in BIO 012L to maximize efficiency.

2.10 Course sequencing. *Not applicable to non-majors biology.*

***2.11 Basic Skills* (if applicable).** The Biology Program does not offer basic skills courses; however, the non-majors biology courses serve many underprepared students. We support our students in a number of ways including:

- Providing lists of student services available through the college;
- Providing lists of study techniques in the course syllabus;
- Providing students with a learning styles inventory;
- Promoting the use of Cornell notes (or similar); and
- Referring students to specific services (e.g. Tutoring Center or the English Lab) for additional support as necessary.

Biology faculty members are also working on additional materials to support our students including developing guidelines for common types of questions, collecting advice on effective study strategies, and developing new courses (BIO 101) to help students with time management and study strategies.

2.12 Student Survey. A total of 215 students responded to the survey that was conducted in the Spring 2014 semester. Survey response rate was approximately 31.5% of the total students enrolled in a non-majors biology course (681) at the time of the survey (April 21-25, 2014). A

disproportionate number of BIO 015 students responded to the survey as compared to those from BIO 016:

Table 11. Percentage of students responding to the Spring 2014 survey versus the percentage of sections.

Non-majors Biology Course	Percentage of Students by Course	Percentage of Students Responding
BIO 012	10.3	6.9
BIO 012L	2.9	4.6
BIO 015	24.0	46.5
BIO 016	50.1	28.6
BIO 016L	6.2	8.3
BIO 018	3.9	NA
BIO 019	2.6	5.0

Sixty percent of students indicated that they are taking their course(s) to transfer while 25 percent are taking their courses in preparation for an allied health major.

Eighty-eight percent of all students agreed or strongly agreed that faculty had mentioned study skills/strategies. However, 80 percent want to be taught more ways to be successful. This goal may be difficult to achieve as 35 percent stated that they worked 20 or more hours per week. Students specifically requested help with time management as a number stated that they were struggling with demands from a job and college. Indeed 62 percent of students stated that they studied less than four hours per week, which is not enough time to master all the course content. Sixty percent of students agreed or strongly agreed that they could have put more time and effort into their courses. When prompted with various study skills and strategies, students clearly expressed a need for more help:

Table 12. Percentage of students who requested help with study skills/strategies.

Study Skill/Strategy	Percentage of Students Indicating Interest in Skill/Strategy
Note taking	36
Time management	52
Test anxiety	36
Goal setting	24

Ways to improve memory	66
Getting organized	28
Essay questions/writing assignments	34
Using a textbook effectively	34
Understanding what I read	45

***2.13 Four-year articulation* (if applicable).** All non-majors biology courses can be used to meet IGETC requirements in Biological Science (Area 5B) and/or Laboratory Requirement (Area 5C). Likewise, non-majors biology courses meet Life Science (Area B2) and/or Laboratory Courses (Area B3) for CSU.

***2.14 High school articulation* (if applicable).** *Not applicable to non-majors biology.*

***2.15 Distance Education* (if applicable).** Two non-majors biology courses (BIO 012 and BIO 016) have been offered as online distance learning courses for more than 10 years now. Over the last five years, online course offerings have increased dramatically for BIO 016 as the interest in Allied Health majors has increased. BIO 016 is also recommended as a prerequisite to BIO 004-Human Anatomy. During the 2013 Fall semester, we began offering BIO 016L as a hybrid laboratory to accompany BIO 016. It is our plan to move BIO 016L to a completely online laboratory by 2016.

All online courses offered by the Biology department require a proctored (face-to-face) final exam. In addition, the faculty who teach BIO 012 and BIO 016 online collaborate closely to assure continuity between different online sections of the same course and with the face-to-face sections taught by the same instructors.

Online classes offered by the Biology department fill quickly and faculty often have waitlists for these courses. Due to the restraints of faculty availability to teach online courses (maximum of nine units per semester per contract) and the time it takes to get new faculty approved to teach online, we have been limited in our ability to expand online offerings.

***2.16 Advisory Boards/Licensing (CTE)* (if applicable).** *Not applicable to non-majors biology.*

STUDENT EQUITY & SUCCESS

3.1 Course Completion and Retention. Faculty members who teach in the non-majors biology program use a variety of techniques to promote student learning. At the beginning of a semester, many faculty members provide their classes with an overview of techniques that promote student success. For example, many faculty members show students how to use Cornell Notes, various graphic organizers, mnemonics, and other study skills. These resources are also listed on the course syllabus. In addition, some faculty members have their students complete a learning styles inventory at the beginning of the semester. As the semester progresses, many faculty refer students to the campus-wide Student Success Workshops (e.g., time management, test anxiety, etc.) and the campus Tutoring Center. Furthermore, many faculty offer review sessions and some participate in study groups.

Technology is an important component to promoting student success in the non-majors program. Many faculty use a companion website as a means to provide students with course materials and useful online resources. Recently, faculty members have collaborated to build a "Study Biology" webpage filled with resources that promote student success. More information about this webpage can be found below (at the end of section 3.1).

Trends in student success for students in non-majors biology courses are similar to the success trends found campus-wide and nation-wide. Student success rates vary significantly based on instruction method, student age, ethnicity, and prior coursework in English and math.

In summary:

- Success differed in non-majors biology courses (BIO 012 and BIO 016) based on instruction method. Specifically, online sections typically had lower success rates than traditional face-to-face classes. This trend is due to numerous factors, many of which are external to the classroom. For example, student motivation and responsibility are often associated with success in online learning environments. As this trend is common in online courses, the issue would be best addressed by the Distance Education Committee.

- Success between female and male students does not appear to differ significantly. Between Fall 2010 and Spring 2014, the average success rate for female students was 55.8% (standard deviation = 2.7) and for male students, the success rate was 57.5% (standard deviation = 3.4).

- Students between the ages of 18-25 had the lowest average success rate of any age group (56%). Students in this age range are the majority of the students in non-majors biology courses (73.2% of the population in non-majors biology courses).

- Success between ethnic groups appeared to differ significantly:

Table 13. Student success in non-majors biology courses by ethnicity.

Ethnicity	Average Success (%)	St Dev	Average % Population Size
Am. Indian	53.9	12.7	3.3
Asian or Pacific Islander	58.5	6.5	18.2
Black, non-Hispanic	39.5	3.7	16.3
Hispanic	52.5	6.7	21.8
Other	60.8	6.3	9.4
White, non-Hispanic	65.1	5.7	30.9

- Success in non-majors biology courses seems to correlate with the first English course a student completed prior to enrolling in a non-majors biology course. In general, the more advanced the English course completed, the greater the success in a non-majors biology course. The least successful students (average success= 41.3%) were those students who did not take any English course at Solano College prior to enrolling in a non-majors biology course; the most successful students were those who had completed English 001 and 002 (success rates = 70.3% and 69.8% respectively).

Table 14. Student success in non-majors biology courses by first English course.

First English course at SCC	Average Success (%)	StDev	Total # Students
No SCC English	41.3	5.7	1127
ENGL 001	70.3	5.7	1290
ENGL 370	53.1	4.4	898
ENGL 310	58.1	9.3	170
ENGL 002	69.8	14.8	136
ENGL 348E	62.7	17.5	120
ENGL 348E w/o F10	68.1	9.2	120

- Similarly, success rates in non-majors biology courses seem to correlate with the first math course completed. Students who completed a math course prior to enrollment in a non-majors biology course succeeded at higher rates. Furthermore, the more advanced the math course completed prior to enrollment, the greater the success in non-majors biology courses. Students who did not complete any math course at Solano College prior

to enrollment only succeeded 39.7% of the time, and the number of these students represents a significant fraction of the total number of students (1127 out of 3871 total students in non-majors biology courses).

Table 15. Student success in non-majors biology courses by first math.

First Math course at SCC	Average Success (%)	StDev	Total # Students
No SCC math	39.7	5.5	1189
Math 104	62.4	4.9	1041
Math 011	74.4	7.3	850
Math 102	54.1	5.9	507
Math 330	48.2	4.3	534
Math 310	42.6	9.2	279
Math 304	62.4	11.4	110
Math 004	76.6	13.4	114

These trends in success are similar to campus-wide and nation-wide trends, and like these broader trends, the reasons for student success in non-majors biology courses are complex and multifactorial. Some of the factors that influence success are not related to the classroom and school setting. Thus, a rigorous analysis to explain student success is beyond the scope of this report. However, biology faculty members are taking action to make a positive difference in some of the trouble spots that non-majors biology students encounter.

In the student survey given to all non-majors classes in the spring of 2014, students reported that they wanted more help with study skills (see section 2.12). As a result of this need, faculty members are collaborating to build a central "clearing house" of resources for students in all non-majors biology courses. Faculty members were asked to contribute their best materials, and the response has been very good. These materials will be available to students as different files on a Solano College webpage. Faculty will also expand their in-class treatment of study skills at the beginning of the semester.

Because many students struggle with the variety of writing tasks found in a biology course, biology faculty have been collaborating with English faculty to produce a series of task-specific writing resources for students. The biology faculty recognized the need to consult English faculty in order to be consistent with the writing standards in English courses. Consequently, English and biology faculty have formally met during the spring 2014 and fall 2014 Flex Cal sessions. The result of this collaboration has been the creation of concise writing guides that describe how to be successful at a specific writing task. For example, many students struggle with compare and contrast questions. The writing guide for this task provides a rubric for an excellent

paragraph, expectations for a response to a compare and contrast question, links to online video tutorials, and sample responses. The idea is that students are given clear expectations for, and possibly an opportunity to practice, a specific writing task before an assessment. Furthermore, students can follow-up with the Drop-in English Lab after they get their assessment returned to them, and consulting with an English faculty member in the lab, students can learn how to further develop their responses in future assessments. Currently, two writing guides have been completed, but as this work continues, guides will be available for other writing tasks.

***3.2 Degrees/Certificates Awarded* (if applicable).** *Not applicable to non-majors biology.*

***3.3 Transfer* (if applicable).** *Not applicable to non-majors biology.*

***3.4 Career Technical Programs* (if applicable).** *Not applicable to non-majors biology.*

PROGRAM RESOURCES

4.1 Human Resources. To promote long-term stability, the Biology Department has several full-time faculty members with exclusive or considerable responsibility for non-majors biology courses: Rennee Moore, Brad Paschal, Michelle Smith, and Gene Thomas. Despite the number of full-time faculty focused on non-majors biology, adjunct faculty carry the majority of FTEF (4-year average 40.0% full-time:60.0% part-time) for these courses. The most recent full-time faculty hire in 2013 shifted the proportion of FTEF (1-year average 52.3% full-time:47.7% part-time); yet this ratio is still far from the 75% full-time:25% part-time faculty standard. An additional full-time faculty member dedicated to non-majors biology would enhance the strength of the Biology Department by ensuring high quality educational experiences for our students.

As student enrollment increases, sections will be added as necessary. New sections of non-majors biology courses require additional faculty as well as staff. The additional administrative assistants are a tremendous asset to the Math & Science Division. Yet science faculty members require additional help. In particular, lab-based courses require extra support; yet many of our lab technicians are already overloaded. For example, the limited transition time between different courses in the same laboratory space requires the assistance of lab technicians. The Vacaville Center lab technician is currently split between biology and chemistry; though the new Science Building at the Vacaville Center will necessitate additional support consisting of a full-time biology technician and a full-time chemistry technician. The new Science Building on the main campus will also require the support of two full-time biology lab technicians. Without additional support, faculty and staff will struggle to continue to provide exceptional learning experiences for our students.

4.2 Current Staffing. Our faculty members have made significant contributions to the biology program and the college as well as the greater community. Several faculty members have benefited the department by developing materials for the non-majors biology courses. For example, Gene Thomas wrote a lab manual for Introduction to Biology and Rennee Moore developed a lab manual with a workbook for Human Biology. These materials are tremendous educational resources that are freely available to students through MySolano and Canvas. Many faculty members contribute to the college through participation in shared governance. For instance, Pam Muick has taken a leadership role with Environmental Science and Environmental Science Laboratory while serving as the faculty advisor for the Environmental Club. Michelle Smith is the Outreach Coordinator for the Sustainability Advisory Community, promoting awareness and implementation of sustainable practices throughout the district. Faculty members also support the greater community by encouraging student participation in community events such as Coastal Cleanup Day. The biology faculty work diligently to promote the program, college, and community.

4.3 Equipment. Biology is a demanding discipline in that it requires substantial resources for the laboratory. Consequently, the Biology Department has the largest budget of the sciences. Yet the non-majors biology courses are currently lacking in equipment and supplies, particularly at the Vallejo and Vacaville Centers. The campus centers also need other basic materials including charts and specimens. The main campus requires new equipment to replace damaged or deteriorating items. For example, the number of functional power supplies has declined substantially over time. This equipment is necessary for gel electrophoresis, a technique common in biology labs. In order to maintain and update laboratory equipment, as indicated in the Education Master Plan, it is necessary to purchase equipment for the main campus as well as the campus centers.

While all biology lectures are held in smart classrooms, faculty members do not have access to advanced technologies such as classroom response systems, or "clickers". Clickers are commonly used in classrooms to promote student engagement with course content while providing faculty with immediate feedback on student comprehension. Nearby institutions, including Diablo Valley College and Napa Valley College, recently implemented standard policies for the use of clickers in classrooms. A classroom response system would enhance the student learning experience at Solano Community College while promoting modern teaching techniques.

4.4 Facilities. The room dedicated to general biology laboratories on the main campus is suitable with the appropriate size and layout for labs; however, the current building does not meet all the needs of the Biology Department. In particular, storage space is extremely limited in the 300 building. Efforts to reduce excess or unnecessary materials are ongoing; however, availability of storage space will continue to be an issue. The area available for students is also inadequate. Many students use the "bird room" for study groups although this space is frequently crowded. The condition of the current building is also unsatisfactory. Despite the recent remodel, the building continues to exhibit numerous issues. Concerns regarding the well-being of students, staff, and faculty using this building are mounting.

The Facilities Master Plan includes new Science buildings on the main campus as well as the Vacaville Center. This represents a tremendous opportunity for expansion in the sciences while updating technology in the classrooms. To make the most of this opportunity, faculty must be able to contribute to the design of these buildings. For example, we are interested in room sizes (e.g. 1550 square feet *minimum*) to ensure quality educational experiences but also to minimize potential safety issues. Classrooms should include multiple display options (e.g. screens and boards) that faculty may use ***simultaneously*** to provide students with multi-format presentations. Layouts of lecture rooms must be amenable to multiple teaching strategies while laboratories must have layouts that allow for collaborative learning within small groups. Laboratories must be supplied with quality instructional equipment (e.g. laptops, microscopes) as well as required supplies (e.g. Ethernet connections). The furnishings and finishes in science laboratories should be durable and reliable including chemical- and stain-resistant surfaces. Laboratories must be supplied with emergency systems including eyewash stations, showers, fire protection, call boxes, and shut-offs. Science courses also require substantial space for preparation (e.g. 400 square feet *minimum*) and storage of materials. In a recent survey, many students indicated interest in an Open Lab to receive help with their biology lectures and labs. This suggestion should be given serious consideration for space in the new buildings. All classrooms must be designed to be safe and accessible for all students, staff, and faculty. Without faculty input on building design, key considerations for instructional objectives as well as issues unique to the sciences may be overlooked.

4.5 Budget/Fiscal Profile. Since 2008, expenses for the Biology Department (Code 040100) ranged from $1.47 – $1.78MM. The majority of the budget went towards academic salaries and benefits. Conversely, relatively little funding is provided for classified salaries which may help explain the high turnover. The expenditures for supplies varied substantially by year. Given the data, it is difficult to identify any clear patterns. Regardless, the Biology Department requires substantial resources every year for supplies, equipment replacement, and new equipment for advancing technologies as well as new courses. While the department has been able to manage with the available resources, additional funding is necessary to continue to improve the program. In particular, it is crucial to increase the budget to support the upcoming expansion at the main campus as well as the campus centers.

PROGRAMMATIC GOALS & PLANNING

5.1 One strength of the non-majors biology program is the variety of course offerings. First, we offer a diverse and specialized curriculum for a student to satisfy their GE requirements for transfer. Students can choose from a wide range of biology courses to find a fit that best match their intrinsic interests. We offer courses in general biology, human biology, environmental science, biology of sex, and marine biology. In addition, many of these courses have a laboratory component, which is another requirement for transfer.

Another strength of the program is the laboratory activities available to students. Students are able to work with high-tech equipment such as gel electrophoresis, gene cloning with plasmids, and spectrophotometers to better understand some of the big topics in modern biology. In addition, many courses include one or more field trips in order to enhance the students' understanding of a classroom topic. Depending on the class, routine field trips include sewage treatment plants, oak woodland preserves, coastal areas such as Pt. Reyes National seashore, local creeks, and science museums in the Bay Area.

Other important accomplishments include:

- New laboratory manuals for BIO 015 and BIO 016L are free to students and accessible on the college website. This dramatically cut down on the students' cost to take these courses. Gene Thomas wrote the BIO 015 lab manual as part of a sabbatical leave, and Rennee Moore wrote the lab manual for BIO 016L as part of a sabbatical leave.
- The human biology course (BIO 016) is a three unit lecture only course, but prior to two years ago it had no laboratory component. A laboratory course (BIO 016L) in human biology is now available to accompany the lecture. So students have a new way to satisfy the laboratory requirement in order to transfer. Rennee Moore created this course as part of a sabbatical leave.
- The laboratory technicians who prepare the biology labs are highly skilled; however, they are overworked and need more assistance (see below).
- New equipment, such as microscopes and instructional models, have been purchased for the non-majors biology lab rooms.
- A variety of non-majors biology courses are offered at the satellite campuses in Vallejo and Vacaville.
- Several courses are using a customized version of the textbook. These versions contain the topics covered in the class, but do not have all of the topics included in the standard versions of the textbook. This is another way in which student costs have been reduced.
- The School of Math/Science now has two administrative assistants.
- Individual instructors have used a variety of strategies and practices to foster success in their students for a long time. Recently, we have gathered some of these learning resources and organized them as part of an online "Biology Study Group," which is accessible to students in the non-majors biology courses.
- Michelle Smith, the new hire in biology, organized and then performed much needed maintenance on a valuable but unfortunately neglected vertebrate specimen collection.
- Brad Paschal and Michelle Smith have created a writing guide to help students improve their ability to answer compare and contrast essay questions. They worked with English faculty in order to align this work with the expectations of students in English courses.
- Standardized SLO assessments have been developed for the scientific method.

Areas in Need of Improvement:

- Although the laboratory technicians are highly skilled, they struggle with the workload required to prep so many lab intensive courses. At the satellite campuses in Vallejo and Vacaville, there is one technician at each location to prep all of the science courses, which includes courses in biology, chemistry, geology, and others. These centers require additional lab preparation support. Please see section 4.1 for more information.

- Given the ratio of full-time to part-time faculty teaching non-majors biology courses, a new faculty hire is necessary. Please see section 4.1 for more information.
- The non-majors biology program's storage needs are not met very well. More storage space is needed.
- Many chairs in the lab rooms need maintenance. Some of these chairs are in pieces and unusable, especially in labs at the Vacaville Center. Some other chairs are usable but have broken parts. This is a safety issue and limits the seating options to students.
- Some types of lab equipment will show routine wear due to normal use and will need to be replaced. Items such as power packs for gel electrophoresis will need to be replaced in the near future.
- Scheduling of non-majors biology courses and labs would benefit from block scheduling. This is a campus-wide issue.

5.2 As we continue to work to improve the Biology Department, we also continue goal planning, implementation, and revision. Consequently, goals are considered to be ongoing.

Table 16. Short-Term and Long-Term Goals

Short- & Long-Term Goals	Person Responsible	Source
1. Hire new full-time non-majors biology faculty member	Hiring Committee	DB
2. Hire new full-time biology lab technician for main campus	Hiring Committee	DB
3. Hire new full-time biology / chemistry lab technician for VJO	Hiring Committee	DB
4. Hire a new full-time biology / chemistry lab technician for VV	Hiring Committee	DB
5. Purchase supplies, replace equipment, and purchase new equipment as necessary	Biology Faculty	DB & SP
6. Improve biology laboratories including prep space and storage areas	Faculty & Staff	DB

SIGNATURE PAGE

6.1 The undersigned faculty in the Non-majors Biology group have read and concur with the finding and recommendations in the attached program review self-study, dated May 1, 2015.

Rennee Moore
Faculty Name

Brad Paschal
Faculty Name

Michelle Smith
Faculty Name

Gene Thomas
Faculty Name