

Skyline College

Science–Mathematics–Technologies Division



Program Review: A self-study of

Biology

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January 1996

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Program Review
Biology
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Skyline College

EXECUTIVE SUMMARY

Major strengths:

1. Our dedication to biology education and our responsiveness to students has resulted in the documented high load (WSCH/FTE) for the Biology Department at Skyline College. We begin each semester with over 100% of the maximum class size; consequently our load is 28% greater than the average load for the College and 42% greater than the average load for the District. The professionalism and energies that lead to curriculum and laboratory development, open labs, and BIOL 690 projects are appreciated by our students and contribute significantly to their success. Student follow-up shows our students do earn baccalaureate degrees in the sciences and do work as professionals in biotechnology, health care, and education. Biology students account for over 50% of Skyline's Transfer Admission Agreements with UC.
2. Our faculty are active in regional and national professional organizations. Under the leadership of our faculty, scientific and educational meetings are brought to Skyline College and our students are able to attend these meetings. Additionally, the Biology Faculty undertake independent outreach efforts visiting K—12 schools, providing formal in-service training for K—12 teachers, and judging local and regional science fairs.
3. The Biology Department has made a commitment to assimilate part-time faculty into regular departmental activities and curriculum matters. Additionally, students and classified staff are always an integral part of departmental activities.
4. In addition to providing for students' academic needs, the Biology Faculty try to meet students' need for professional experience by placing Biology majors in paid and unpaid internships in private companies in Northern California. The faculty regularly volunteer their time to offer BIOL 690, open labs, and science seminars, and to advise students.

Challenges and opportunities:

1. The Biology Department accounts for 6.5% of the College's WSCH but receives only 4.3% of the budget. Biology is a laboratory science that requires students to master discipline-specific technology. Each laboratory requires equipment and consumable supplies. Advances in biology are occurring at a rapid pace and high school students are doing sophisticated DNA labs. We must be positioned with state-of-the-art equipment and sufficient supplies to advance the knowledge of the next class of transfer students and continue to prepare our students for the work force.
2. The Biology Faculty workload is 42% higher than the average load for the District and 31% higher than the average load in the State. Part-time faculty have increased 600% while full-time FTE has not changed. Forty-three percent of Biology FTE are part-time faculty and 49 teaching units are assigned either as overload or to part-time faculty. This presents problems because (a) lab courses require use and care of equipment and (b) continued curriculum development in existing and new courses requires full-time faculty.
3. Skyline is ideally situated, both geographically and experientially, to develop a certificate program in biotechnology. This will require faculty time to work with an advisory committee and to develop curriculum and job referrals.
4. Biology is an ideal discipline to offer topical courses such as emerging diseases, cancer, and DNA science; and interdisciplinary courses in P.E. and physiology, biotechnology and society, and bioethics. We are aware of the need for such courses and welcome the opportunity to develop some.
5. Another follow-up of transfer students should be done within the next five years.

We believe in the Program Review process and have thoughtfully and professionally undertaken this program review. We are committed to biology education, our students, and to Skyline College and will appreciate a response to this Program Review and to the budget request in Part VII.

I. OVERVIEW OF PROGRAM

The goals of the Biology Department at Skyline College are consistent with the stated goals of the College (19). The first two College goals are:

1. "Provide varied general educational opportunities which acquaint students with the broader outlines of human knowledge and experience." Courses numbered BIOL 100—199 are specifically designed to provide students with a scope of information which will help them to objectively deal with the events and responsibilities of daily life. Consistent with these goals we have developed General Education Guidelines for science education (Appendix A). These guidelines are in accordance with the policies of national organizations for science education (11).
2. "Provide lower-division transfer programs which prepare students for continued education in four-year colleges and universities." Courses numbered BIOL 100—299 are transferable to UC and CSU. Courses numbered BIOL 200—299 are carefully designed and articulated for Biology and Allied Health Science majors transferring to four-year schools.

In 1986, it was recommended "that the highest priority and primary functions of the California Community Colleges be reaffirmed as the provision of rigorous, high quality lower division instruction" because students and society benefit from the education obtained from a transfer program (8). The federal government is especially concerned with science education and it was clearly stated at the 1995 National Research Council-National Science Foundation convocation that the undergraduate years should produce literate citizens and lead toward a workforce of competent science professionals (11). The Biology Program contributes to providing the prerequisite courses necessary for students to transfer to four-year schools, to prepare for professional schools (e.g., medical and veterinary), and to enter professional programs (e.g., dental hygiene and nursing). Moreover, students completing the Biotechnology degree are prepared for and entering the workforce. The Biology Department has three major areas of focus. *General Education*, *Majors* which includes Biology and Biotechnology majors, and *Allied Health Science*. We work closely with other programs including Chemistry, Mathematics, Physics, and Respiratory Therapy in order to develop sequences of courses and coverage of topics needed to complete lower division work in Biology and Allied Health Science. Consistent with our commitment to provide science education as science is actually done, we have developed an animal use policy (Appendix B) and laboratory safety guidelines (Appendix C).

These programs do not have advisory boards, however, our faculty are active in regional and national professional organizations. Our faculty contribute to the literature, make presentations, serve as board members, and bring professional organizations to our students. Under the leadership of our faculty, the following scientific and educational meetings have been held at Skyline College during the past six years. Our students have been able to attend these meetings:

- Partnership in Biology (UC, CSU, and community colleges)
- Northern California American Society for Microbiology Fall meeting
- Northern California Society for Industrial Microbiology general meeting
- Bay Area Biotechnology Education Consortium general meetings
- Strategies for Success in the Life Sciences

The faculty regularly involve staff and students in professional organizations in order to provide professional development options for staff and to nurture students' interest in science and to help them meet and form personal contacts with professionals working in the life sciences.

- Ms. Patricia Carter, Biology Lab Technician, has made technical presentations at the Council of Math Science Educators of San Mateo County and Expanding Your Horizons.
- Ms. Sandra Garcia, SMT Division Staff Assistant, chairs an Expanding Your Horizons committee and regularly provides support beyond her job description for our outreach activities.
- Our students regularly attend the Northern California Society for Industrial Microbiology general meetings and Northern California American Society for Microbiology semi-annual meetings.

- While at Skyline our students are involved in helping students through Expanding Your Horizons and The Learning Center. After transferring, Biology students at various UC campuses make themselves available in person and via E-mail to help current students. After they earn their bachelor degrees, our students return to be presenters at Expanding Your Horizons.

Additionally, the faculty “bring” industry to Skyline through the Science Seminar Series. Local scientists and health care professionals present seminars on Friday afternoons during the Spring semester.

General Education

General Education (G.E.) Biology courses are designated BIOL 100—199 although students can fulfill their General Education requirement with 200—series courses.

The G.E. Biology courses are specifically designed to promote scientific literacy and therefore good citizenship. The ability to make decisions regarding personal nutrition, environmental resources, and health care require the information and problem-solving skills to which students are exposed in science classes (18).

In one (unpublished) study of students in our G.E. Biology classes, students’ interest in science increased dramatically after their Biology course (Table 1).

Table 1. Changes in student attitudes in G.E. Biology classes			
	First day	Last day	Percent
	Strongly agree—agree	Strongly agree—agree	change
I feel at ease in biology and like it very much.	42%	62%	+48
On a semantic difference scale: Biology is Valuable Useless	First day Chose Valuable 43%	Last day Chose Valuable 83%	Percent change +93
How frightened are you by... Reading the Theater page...	First day Not-A little 77%	Last day Not-A little 93%	Percent change +21
Reading the Science page...	12%	90%	+650

The Educational Testing Service has published data from an on-going assessment of over 240,000 young people’s proficiency in science. They found students could recall basic facts of biology but could not apply this information or analyze data. When asked whether science will help me earn a living or whether I will use science in my work most respondents answered “no” to both questions (13). One of our goals is to help our students learn that science education provides valuable job skills. Biologist was ranked first in a 1992 survey of the 100 “best jobs in America.” A more important point is that 90% of the top 10 jobs require science or math education and 50% of the top 50 jobs require science or math, while only eight percent of the jobs in the bottom 50 require science or math (2). Nonmajors would have no way of knowing the relationship between science education and having a satisfying job unless we can show them.

It is part of our obligation as biologists to train the next generation of biologists. Students in G.E. Biology classes do decide to major in Biology. Furthermore, we are aware that African Americans, Hispanics, and Southeast Asians are not adequately represented in science-related professions. Our classes reflect the diversity of Skyline College and we work very hard to ensure that these individuals benefit from the job opportunities and from the self-esteem that come from science education. They, in turn, will have an impact on society by providing services for their cultural communities and role models for the next generation.

Majors

The core program for biology majors consists of two courses, BIOL 215 (Organismal Biology) and BIOL 230 (Introduction to Cell Biology). The primary goal of this program is to prepare

students for upper division work at their transfer institutions. This is done through courses which offer a diversity of topics and emphasize critical thinking and laboratory skills. Students are asked to write laboratory reports (two per week in Biology 215 and one per week in Biology 230), and turn in research papers.

Biology majors are also encouraged to do an independent study (BIOL 690) project. These include research projects, internships and organizing science seminars. Research projects include an analysis of the new antimicrobial agents, a study of bacterial chemotaxis, and a demonstration of animal respiration. Students have done internships at a variety of sites including the Marine Science Institute and Genencor.

We know that Biology students are dedicated to achieving their goals and made their commitment to science while at Skyline College. A follow-up study of majors showed that they feel that the education they received at Skyline College provides a quality stepping-stone for continued education; the majority of these students have completed their baccalaureate degrees and are working in science and science-related fields (7). The students perceived the most important part of this education to be

- quality instruction equal to or better than their transfer institutions
- small class size
- personal attention by the faculty

The majors program at Skyline College has changed over the years to accommodate new technology and new ways of teaching biology. We work closely with UC and CSU to articulate our courses. Along with UC-Davis, we were one of the leaders in Northern California developing an integrated approach to BIOL 215-BIOL 230. Zoology and botany were once the two core courses for biology majors. More recent thinking in the teaching of biology has emphasized evolution and the similarities between animals and plants leading to the integration of concepts of zoology and botany into an organismal biology (BIOL 215) and cell biology (BIOL 230) course.

Skyline has kept up with recent technology in both courses. Students perform laboratory experiments and use equipment that is not available to them as freshman or sophomores at four-year schools. They enter their transfer program better prepared than students attending the four-year school from their freshman year.

We recently introduced the computer as a method of analyzing data in BIOL 215. The programs were set up so students learn to use applications required in upper division work (e.g., spreadsheets, graphing, and databases) while they also learn to analyze their individual experimental results.

Allied Health Science

Allied health science classes are intended to prepare students to function in a medical setting, usually under direct or indirect authority of a physician. In biology, the three primary allied health science classes designed to achieve this goal are BIOL 250 (Human Anatomy), BIOL 260 (Introduction to Physiology), and BIOL 240 (Microbiology). BIOL 250 and BIOL 260 introduce students to the normal structure and function of the human body. BIOL 240 emphasizes the relations of microorganisms to the human body and infectious disease control.

One or more of these classes are required for most allied health programs including the Respiratory Therapy program at Skyline College. The classes are also required for transfer allied health programs taught at other schools, such as nursing, dental hygiene, physician assistant, physical therapy, radiology technician, and surgical technology and medical records and transcribing (also at Skyline). To ensure that the basic allied health science classes are meeting the needs of these diverse programs, frequent communication is made with people responsible for these programs.

As explained to us by our students, these health professions are viewed with considerable prestige in some cultures. Consequently, students of varied ethnic backgrounds are in the classes. The percentage of Filipino students in these classes is higher than their percentage in the College. Every effort is made to accommodate people of different ethnic origins and all students are expected to achieve a minimal level of competency in the allied health science classes.

A continuous effort is made towards the goal of having all students reach a minimum standard of competence and preparation for entering a chosen allied health field. Since the field is so diverse the allied health science classes emphasize a rigorous fundamental approach that is intended to prepare any student for entrance and success in any allied health field. The medical field is presently in a rapid state of change and workers in the field are expected to be able to adapt and learn new techniques and applications as they develop and as requirements change. As judged by the feedback received from former students who felt that they were well-prepared at Skyline College when they entered their programs, these goals are presently being met. Also, the administrator of the University of San Francisco nursing program wrote to Skyline College stating that the students from Skyline were the best prepared of all the students that enter their program.

Three of the greatest strengths of the allied health science program are

- their rigorous content and emphasis on basic science
- applications of the basic principles to clinical medicine and independent thinking
- the desire to help all students learn as much as possible to prepare them for their career goals.

These strengths are also the goals for which we strive and seek to improve.

II. CURRICULAR OFFERINGS

General Education

There is a broad diversity of subjects in both lecture and lab classes. Diversity includes basic biology, marine biology, animals and man, intertidal interpretation, nature study, and human biology topics. Multiple sections have been used to accommodate the many transfer-program students where lab space limits the size of any single section. All classes may be used to fulfill the Natural Sciences requirement for an Associate Degree and are transferable to UC and CSU.

The G.E. Biology courses include four 3-unit lecture/discussion courses and three 4-unit laboratory courses. One natural science lab class is required for transfer to a four-year school. In the G.E. Biology lab classes, students are able to use the equipment and problem-solving skills of science. The laboratory courses have three lecture-hours and three laboratory-hours per week. G.E. Biology courses adhere to the General Education guidelines established by the Science-Mathematics-Technologies Division (Appendix A), Title V and the Intersegmental General Education Transfer Curriculum.

Our students will benefit from a cleaner learning environment. Laboratory floors must be washed weekly, walls with peeling paint must be repainted, and the temperature must be stabilized near 20°C. Faced with increased enrollment, we need equipment to replace worn items and to augment meager supplies so each student can have the hands-on experience they need. The Learning Center provides tutors for students in biology, however, with increased enrollments there is a need for more tutors and concomitant funding for The Learning Center.

Majors

Skyline has prepared a transfer program to prepare students for upper division work in the biological sciences. We developed curricula that allow students the opportunity to learn concepts and master laboratory techniques and equipment that they will need as upper division students. After transferring, our students have told us that "I learned lab techniques at Skyline that were....overlooked at (my transfer school)" (7). Moreover, Skyline students are ready to meet the widely publicized need for bioscience technicians. (1, 10) The courses offered to our biology majors do prepare them for both work as biology technicians and for upper division course work at a transfer university.

The beginning course for majors (BIOL 215) is offered every semester to provide potential life science majors an opportunity to immediately begin their pursuits. BIOL 230 is offered in the spring semester only since it has two prerequisites (BIOL 215 and CHEM 210/218) that greatly limit the number of students who are prepared for it.

In the future, we plan to make the computer an integral part of the program. Computer knowledge is critical in today's scientific endeavors. Students began using a computer in the BIOL 215 lab during the Fall 1995 semester. BIOL 230 will be implementing computer-use for data analysis in the Spring 1996 semester.

Allied Health Science

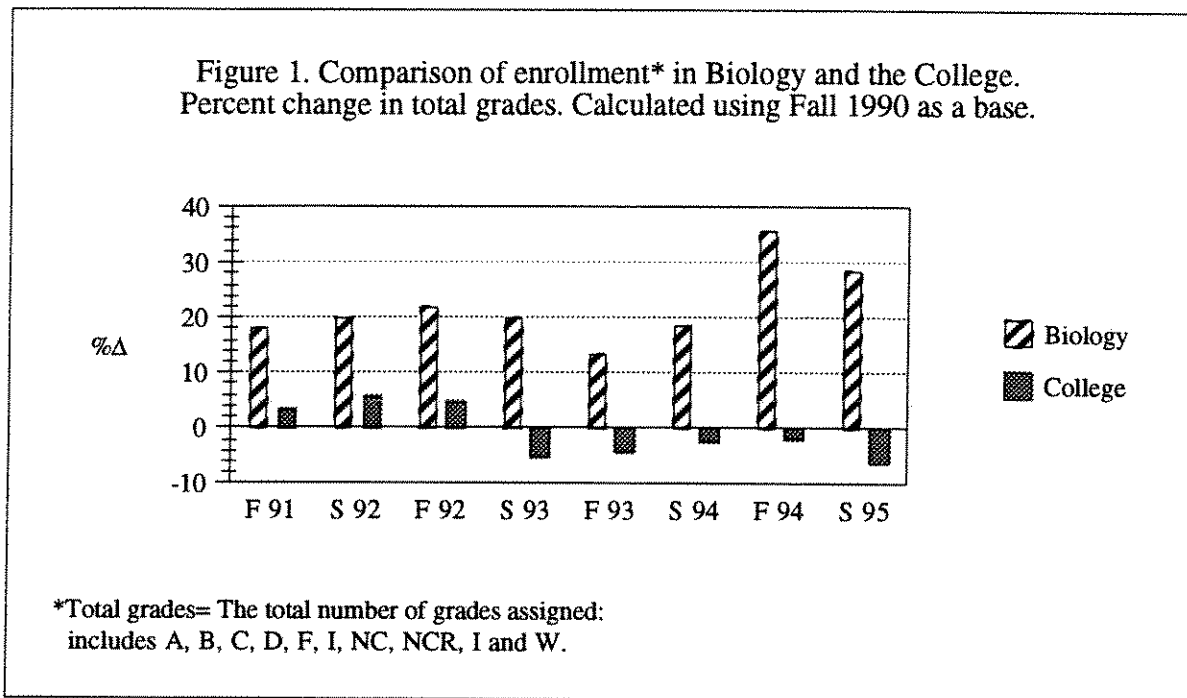
Students need anatomy, physiology, and microbiology with labs and are provided with multiple sections that include day and evening opportunities. Students use these classes to qualify for admission to allied health programs at Skyline or other community colleges as well as transfer to university allied health programs and professional programs. Those who choose not to pursue allied health can use these courses to fulfill their general education life science requirement.

Since these are academically rigorous classes being taught to many students with minimal backgrounds in science the instructors voluntarily maintain open labs so students can do additional work in the lab. Additional resources for tutors, especially during laboratory sessions are needed.

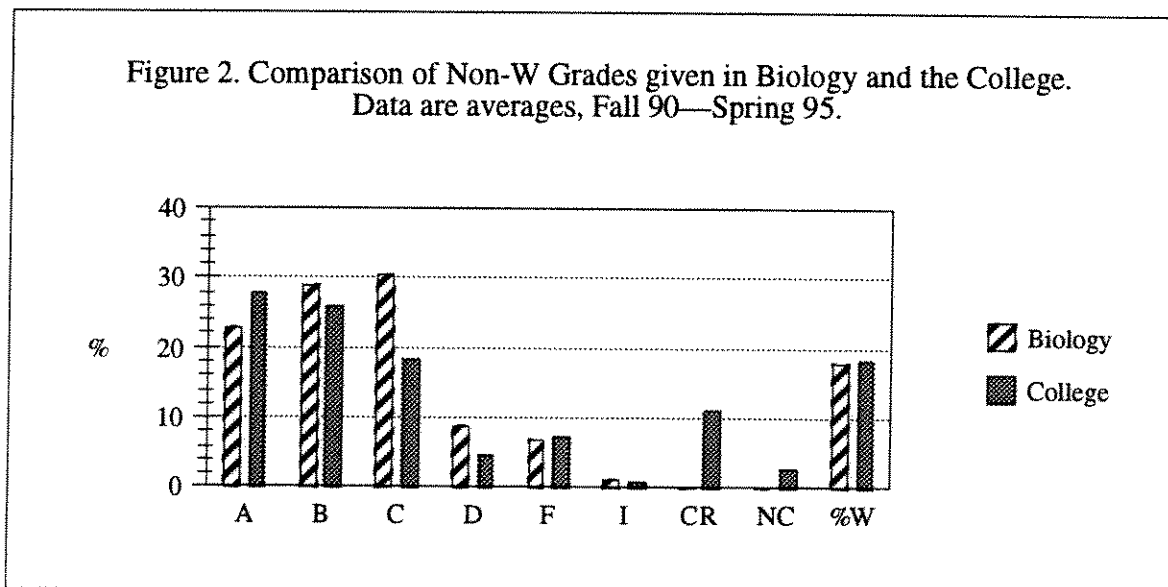
Each semester, we begin these classes with more than the maximum number of students to try to accommodate all students who desire to enroll in allied health science classes.

III. ENROLLMENT AND PERFORMANCE TRENDS*

Since Fall 1990, enrollment in Biology has increased 29% over the five-year period; compared to the College enrollment change of -6%. The enrollment trends in Biology and the College are compared in Figure 1.

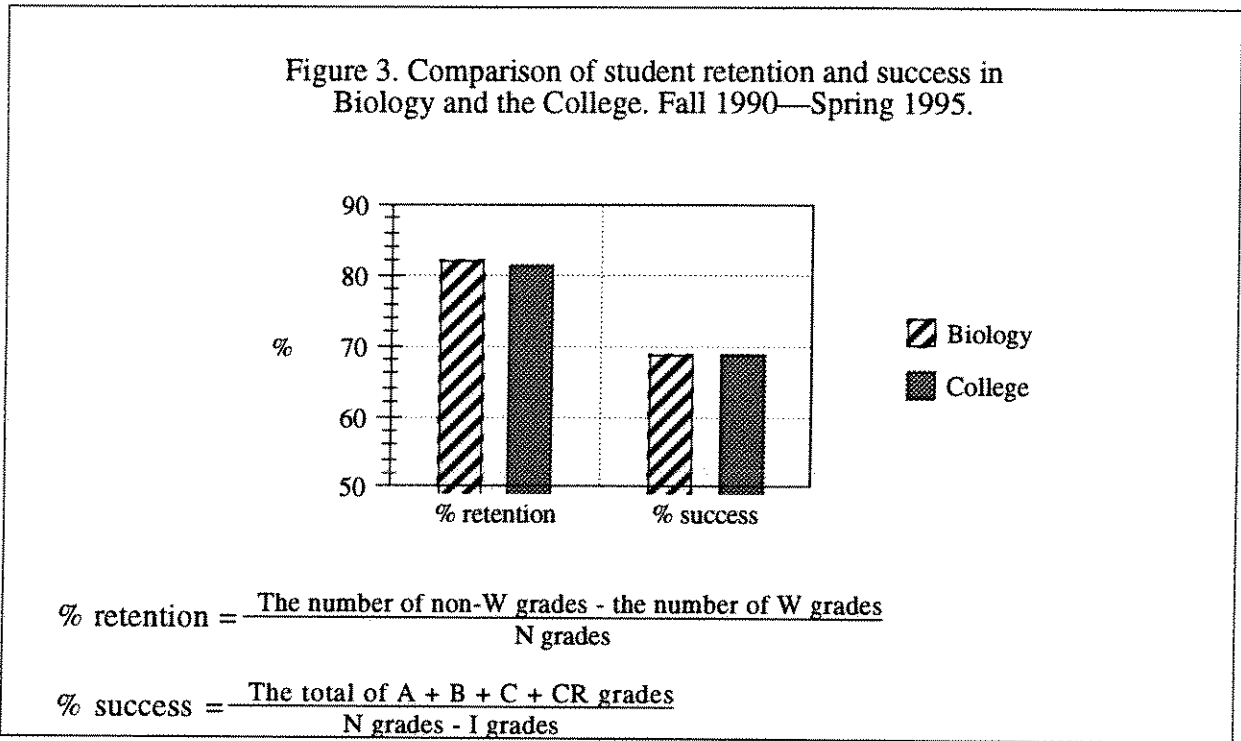


For non-W grades awarded, 82.8% of Biology students earned grades of A, B, or C (there are no CR/NC courses in Biology); College-wide, 83.3% of students earned grades of A, B, C, and CR (Figure 2).

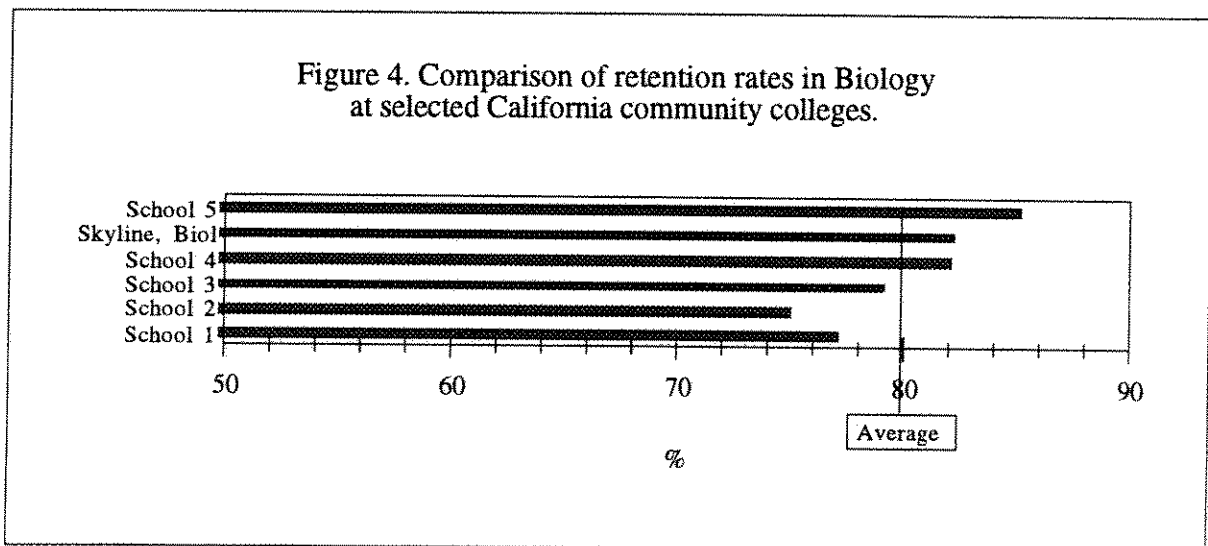


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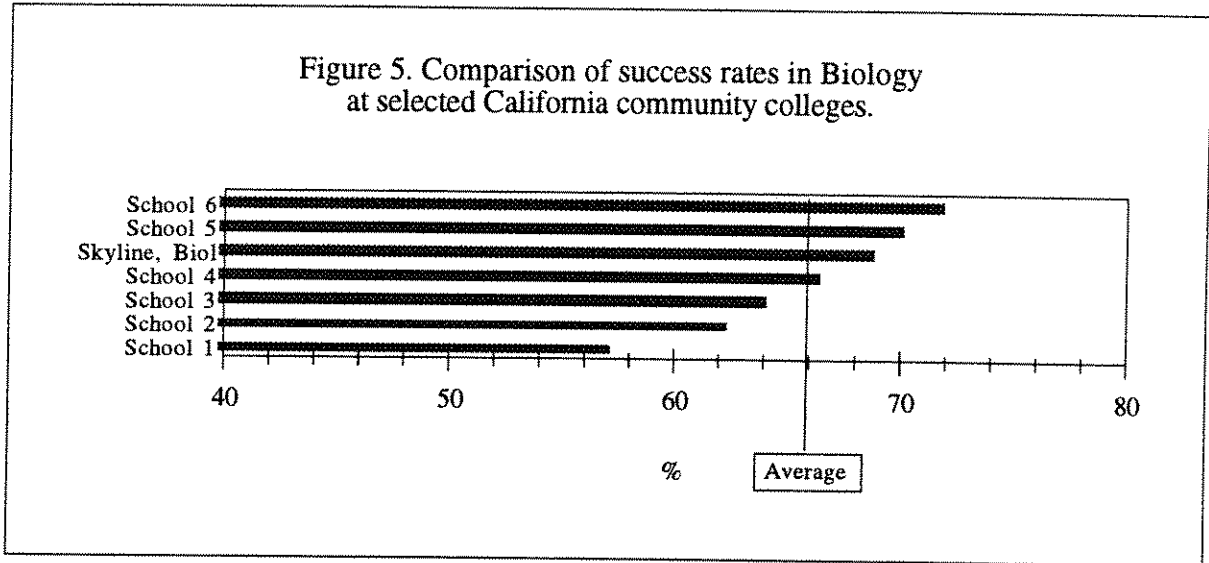
Student retention in Biology (82.1%) was slightly higher than that of the College (81.5%). The student success rate was about the same for Biology (68.7%) and the College (68.8%) (Figure 3).



Retention and success rates need to be compared to the rates at other California community colleges to ascertain their significance. Data are not available for a definitive comparison, however, a sample comparison made from published reports available at the College showed the Biology retention and success rates are comparable to Biology at other colleges (see Figures 4 and 5).



The majority of Biology majors do transfer to four-year schools (7) and biology majors account for over 50% of the Transfer Admission Agreements made between Skyline College and

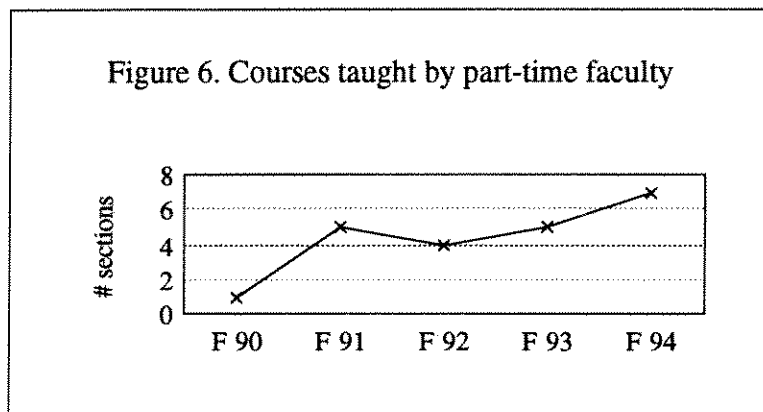


UC (9). Two of the three recipients of the prestigious UC Leadership Award were Skyline Biology majors.

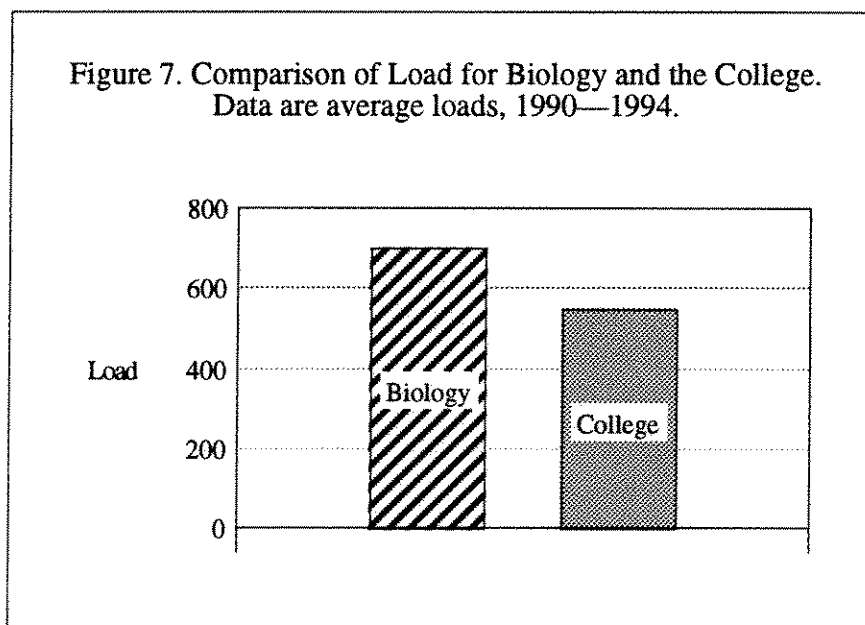
Our students are successful because they are motivated and strive to succeed *and* because we work very hard to provide them with the necessary tools to succeed. Biology Faculty are available for many hours beyond their required office hours to work with students. Moreover, we work closely with The Learning Center, the Library, and Student Services to enhance students success. Students can receive tutoring in The Learning Center. The Library staff works with Biology Faculty and students so students can do literature searches (1) for current assignments and (2) to be sure they are prepared for transfer to a four-year school. We direct Majors to the Counseling Division for career exploration and for information on transfer schools and to complete university applications and Transfer Admission Agreements.

IV. FTE AND WSCH/FTE (LOAD)*

Full-time faculty was unchanged between Fall 1990 and Fall 1994. We are concerned about the increasing number of sections taught by part-time faculty; in fact, over 40% of Biology FTE are part-time faculty (Figure 6). This is especially significant in laboratory courses where equipment must be carefully calibrated and maintained and new experiments must be developed to reflect developments in the biological sciences. This creates extra work for the full-time faculty and for the Biology Lab Technician who frequently must provide instruction for equipment and special techniques to part-time faculty. The burden of maintaining facilities and equipment and determining the need for repair, upgrades, and program development falls to full-time faculty and the Technician. The faculty must do this outside of their normal work hours.

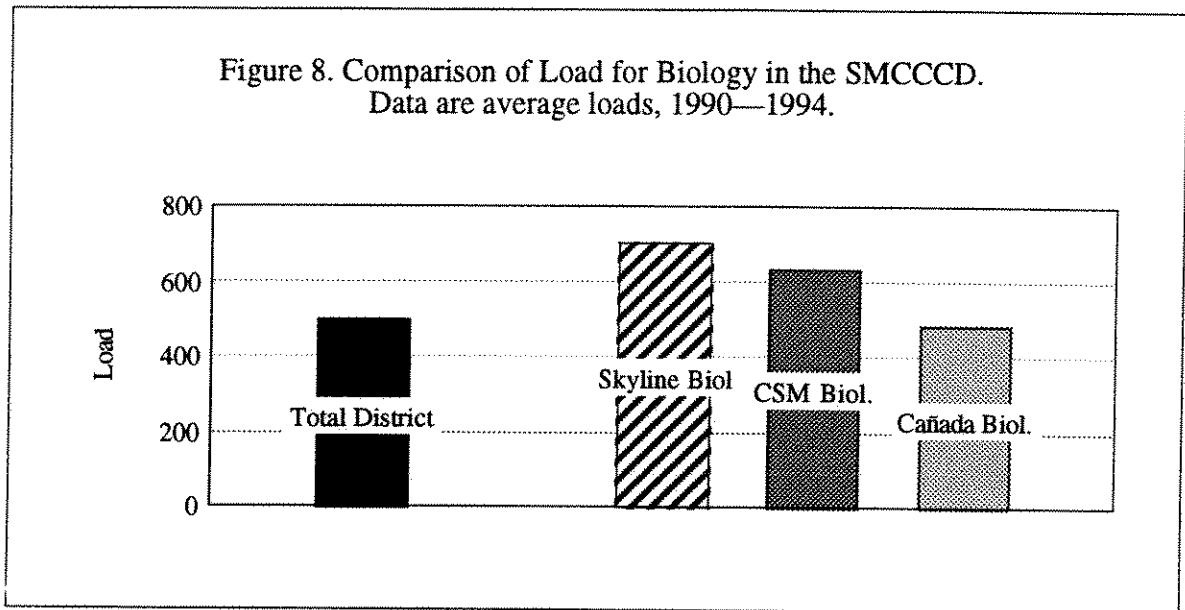


The Biology Faculty load is 28% greater than the average load for the College and 42% greater than the average load for the District (Figure 7).

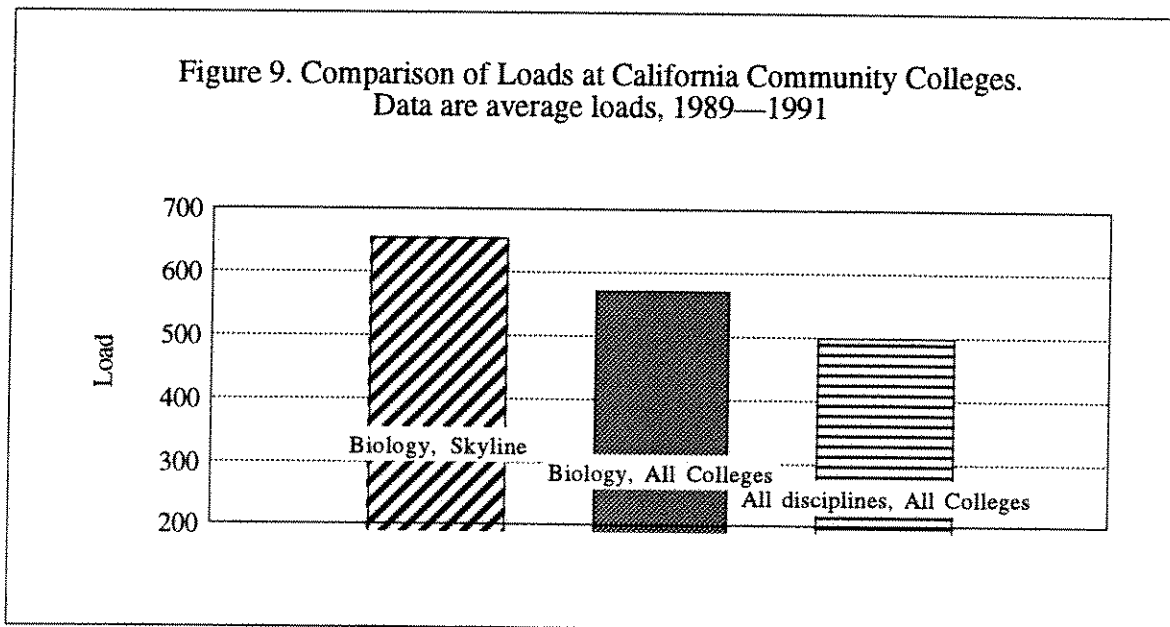


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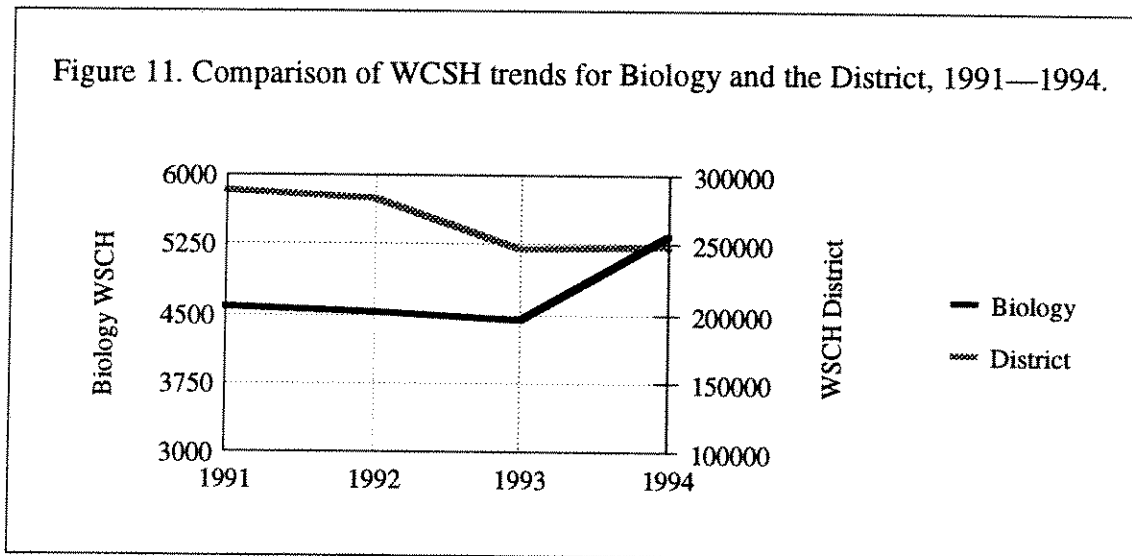
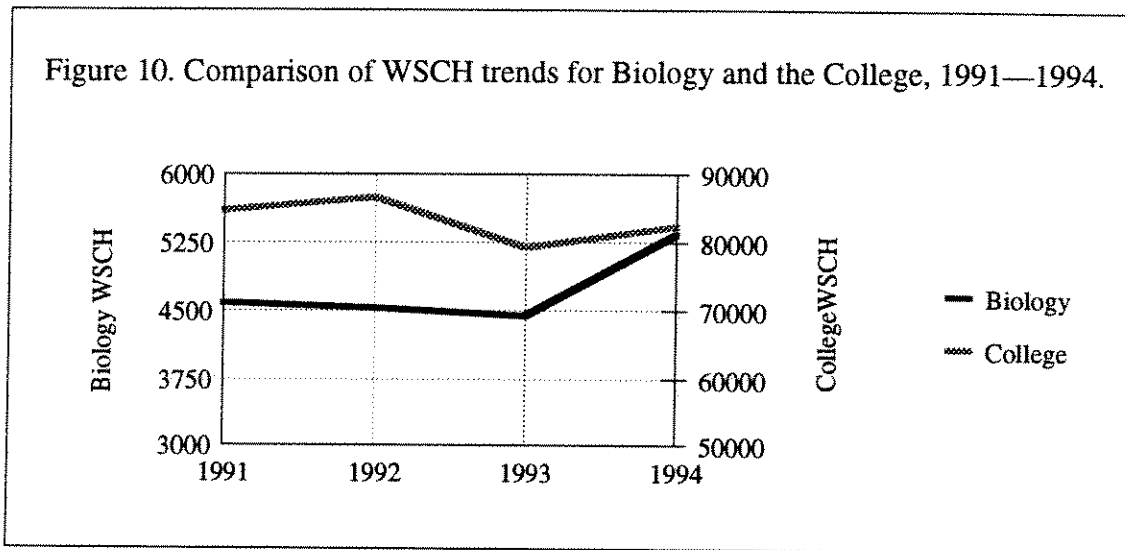
The “Load Study for Major Areas” shows that the Biology Department at Skyline College has the highest load in the District. Skyline Biology is compared to the District total and Biology at CSM and Cañada College in Figure 8.



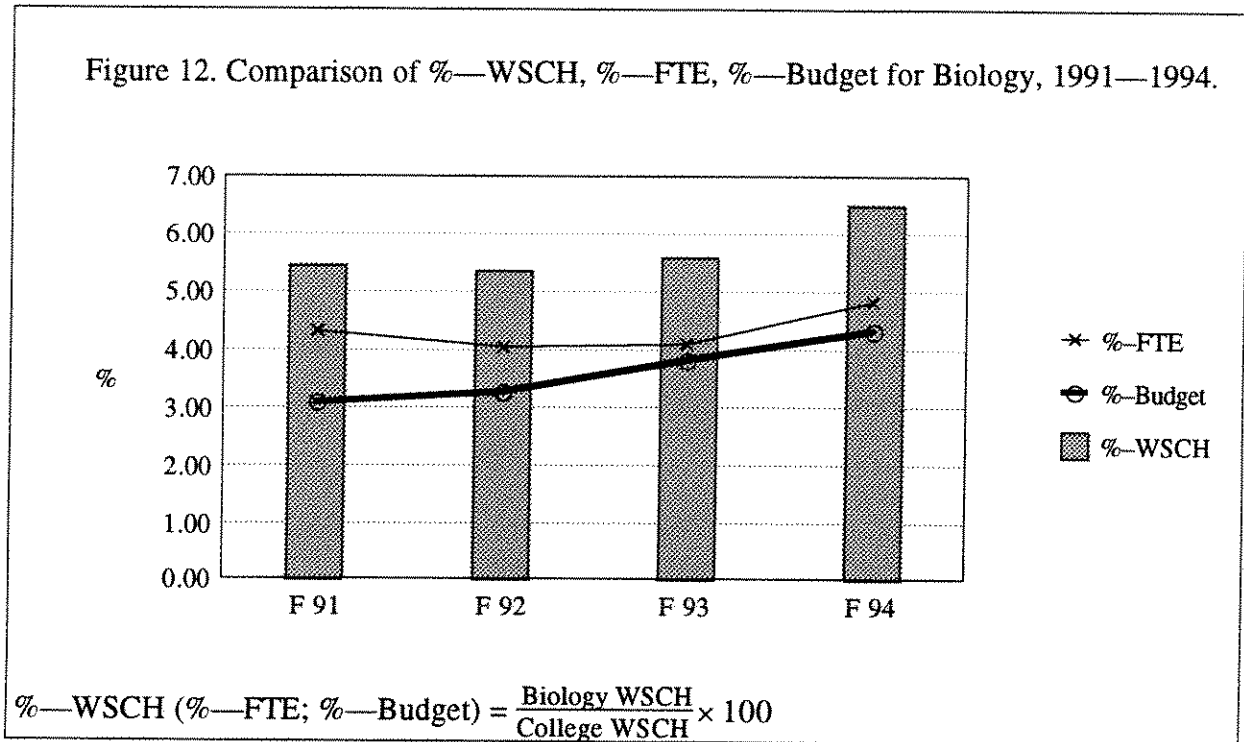
The most recent available data from the State shows that the average load for the Biology Department at Skyline College for 1989—1991 was 31% higher than the average workload for all disciplines in the California Community Colleges and 15% higher than the average workload for Biological Sciences at all California Community Colleges (Figure 9) (16).



Between 1990 and 1994, the Biology Department experienced an increase in WSCH of 17%. During that same time period, the change in WSCH for the College was -3% and -14% for the District (Figures 10 and 11). We regularly take 30 students in a lab section (the number of lab stations) although the national average for college laboratory biology classes is 24 students and 24 students is the maximum recommended to provide a safe and effective learning experience (20).



WSCH, FTE, and budget are compared in Figure 12 (17). For Fall 1994, the Biology Department had 4.8% of the College's FTE and accounted for 6.5% of the College's WSCH. Keeping in mind that the College's income is based on WSCH, the Biology Department receives only 4.3% of the College budget.



- **Expected Enrollment Trends**

The Biology Department at Skyline College is at capacity. We have started each semester at over 100%—full; between 1991 and 1994, the average class size was 102% of maximum size at first census. Between 1991 and 1994, we generated an average of 5.7% of the College's WSCH and received an average of 3.6% of the College budget. Our enrollment will remain static over the next six years without additional funding for equipment, supplies, and faculty and increased space for classes.

The need for more laboratory space was recognized by the College in 1993. The Vocational/Technical Training Addition was proposed by College administration to build additional laboratories in Building 7. This plan must be implemented if we are to meet the needs of present and future students.

V. FACULTY AND STAFF

A. *Major development activities completed by faculty and staff in this program in the last six years. What development activities are needed or proposed by faculty in this program?*

• **Major Developments Completed**

General Education:

BIOL 101 The laboratory portion of this class uses auto-tutorial instruction. Professor Case developed the (16) auto-tutorial modules used by the students. The current technology uses slide-tape format; three modules are computer-assisted.

BIOL 110 A laboratory analyzing DNA using RFLP methodology was recently incorporated into this non-majors course. Associate Professor Snitovsky developed two labs studying DNA; the RFLP analysis and a laboratory on human karyotyping. Both are being used successfully. Professor Wodehouse has written lab report sheets to accompany the laboratory manual which students are required to turn in for credit. Recent emphasis on group learning, development of study groups and tutoring at The Learning Center have resulted in better performance on the part of students.

BIOL 111 Associate Professor Snitovsky is developing lab and field materials for use in this class. She is developing this course for the Spring 1997 semester to provide another lab course for students to fulfill their general education requirement for transfer. She has completely redesigned Skyline's previous BIOL 111 course; this course will be 4 units and transferable to CSU and UC.

BIOL 130 This course has been staffed entirely by part time faculty since 1991. No full-time faculty has had the time to develop this class while working on the other courses.

BIOL 140 Associate Professor Snitovsky has compiled a custom textbook for use in this course. This course is a three-unit, non-majors course with subject matter ranging from evolution of animals to animal behavior to the ecology of endangered species.

BIOL 145 Professor Wodehouse has included a library research paper that enables students to learn and use automated search techniques in the library. Professor Wodehouse keeps the course content up-to-date; recently included topics are genetic engineering and gardening in drought cycles.

BIOL 150 Professor Zucker has expanded the curriculum to include more comprehensive coverage of recent discoveries in evolutionary biology. New topics including reptilian, avian, mammalian, and arthropod evolution are reviewed, illustrated and supplemented to traditional text material. Applications of marine biology to governmental policies, environmental concerns, and current events are updated regularly.

Majors:

BIOL 215 Associate Professor Snitovsky and Professor Case have written the lab manual for this course. The manual is revised annually to include new developments and techniques in bioscience. In the Fall 1995, computer use was introduced into the curriculum. Students are now using a computer to analyze their lab data.

BIOL 230 Professor Case has written the lab manual used for this course (at Skyline College, College of San Mateo, Cañada College, and Menlo College). The manual is revised annually to include new techniques in bioscience. In Spring 1995, polymerase chain reaction (PCR) and bioreactors were added. In the Spring 1996, computer acquisition of lab data will be added. Professor Case has also written *Study Guide for Cell Biology* (HarperCollins Publishers, 1995).

Allied Health Science:

BIOL 240 Professor Case co-authored the textbook, *Microbiology: An Introduction*, 5th ed., and lab manual, *Laboratory Experiments in Microbiology, Laboratory Experiments in Microbiology*, 4th ed. (Benjamin/Cummings Publishing Co., 1995) used in General Microbiology at 900 colleges and universities in the United States.

BIOL 250 Professor Sundberg has written more than 500 pages of notes to provide study guides for students. Professor Sundberg has compiled customized laboratory

BIOL 260 manuals for BIOL 250 and BIOL 260. Professor Sundberg has introduced the use of electronic recorders called physiographs in the BIOL 260 lab. He started using a video microscope in the BIOL 250 lab during the Fall 1995 semester.

Special Purpose:

BIOL 365 This course has been offered as an experimental (BIOL 680) course for several years and was made a permanent part of our program in the Fall 1994. This course is a joint partnership between Coyote Point Musum and Skyline College.

Independent Study:

BIOL 690 Faculty regularly volunteer to offer Biology 690—Independent Study for students. In Biology 690 students have an industry internship or do independent research on a specific topic in Biology. Biology 690 students have presented their research at the Undergraduate Research Conference and at the Northern California Society for Industrial Microbiology student poster session.

OPEN LAB Laboratories are kept open during times when no classes are scheduled in them. Students work under the supervision of faculty to make-up missed labs, repeat experiments in which they made technical errors, or review lab material to achieve mastery. This teaches the students to work independently and allows students to master equipment and techniques. The Majors and Allied Health Science students feel this extra time is invaluable. They know they will have to show mastery at their next level (i.e., upper division work or professional school).

Biotechnology:

A transfer program to prepare students for upper division work in the biological sciences was developed in 1989. We developed curricula that allowed students the opportunity to learn concepts and master laboratory techniques and equipment they would need as upper division students. Moreover, Skyline students are ready to meet the widely publicized need for bioscience technicians. Skyline began by telling local biotechnology companies that our students represented a trained labor force, already acclimatized to the high cost of living in the Bay Area, and will not feel the frustrations of B.S.-degree holders in entry-level jobs. Among the companies that have hired our students during the last six years are Chiron, Genentech, Genencor, Novo Nordisk Biotech, Biosys, and Terrapin.

Working with the Northern California Society for Industrial Microbiology, especially managers at Chiron and Somatix, we placed our first intern in 1991 at Biosys—the summer before she began her junior year.

Professor Case is a member of the Bioscience Skills Standards Project and has authored *Post-secondary Bioscience Curriculum Guidelines* (Education Development Center, 1995) and is a member of the National Bioscience Skills Standards Project. We are implementing some

experimental courses in Biotechnology in anticipation of developing a certificate program. These are all lab courses. We have offered one semester-length course (BIOL 682—Introduction to Biotechnology) and we have had requests from individuals and companies to provide training in specific areas of biotechnology. We have developed and received approval from the Curriculum Committee to offer BIOL 683—Foundations of Biotechnology, BIOL 684—Genetic Engineering, and BIOL 685—Introduction to Immunology.

In the College and District:

All members of the Biology Department regularly serve on Division, College, and District Committees: at present Associate Professor Snitovsky is on the Educational Policy Committee and Professor Sundberg is on the College Council. Professor Wodehouse served a long tenure as chair of the Curriculum Committee and he led the College's Title V curriculum revision process. Ms. Carter is serving on the Health and Safety Committee.

Professor Zucker served as Division academic advisor and counselor for many years. This provided science majors with guidance in academic and personal planning and allowed coordination between faculty and administration for curriculum design and scheduling.

Biology Faculty have received many Trustees' Fund and Professional Development grants and have used these grants to continue curriculum development. Some examples include development of Nature Study Labs, A Trail Guide to Sweeney Ridge, and computer use in Cell Biology.

Professor Sundberg regularly communicates with faculty in allied health programs (e.g., Nursing at CSM) so he can provide both the Biology content and professional advice these students need.

Interdisciplinary:

During Spring 1995 the Biology Faculty developed a course outline for ANTH 125—Physical Anthropology which was approved by the Curriculum Committee. This course had not been offered at Skyline is over 10 years and is a required course for Psychology majors at UC—Berkeley and UC—Davis. We interviewed and hired a part-time instructor who will teach ANTH 125 in the Spring 1996 semester.

Outreach efforts:

The Biology Faculty are active in community and professional activities:

Professor Zucker has brought a variety of programs with biological themes into the community. His productions which use varied media include dinosaurs, sea monsters, horses, and sharks are prepared for elementary school, middle school, high school, and adult students. Professor Zucker makes presentations throughout the San Mateo and Santa Clara library systems as well as at public and private schools.

Professor Sundberg volunteers to teach Biology classes at Franklin School and Burlingame Intermediate School.

Professor Wodehouse is working with the City of Pacifica to develop educational uses for a wetlands restoration project and the city's proposed sewage treatment plant.

Professor Case applied for and received a three-year Eisenhower grant from the California Post-secondary Commission to develop and implement a training program for middle- and high-school teachers. The Summer Institute in Microbiology and Biotechnology for 7th–12th grade science teachers was offered during the 1991–1993 summers. In addition to providing education and training, supplies were given to teacher-participants for use in their classes. The teachers are still coming to Skyline for assistance and supplies.

Science Seminars have been offered regularly during the Spring semesters since 1975. Professionals from the health professions, academia, and the biotechnology industry present content-based talks followed by a question-and-answer period with students, faculty, and staff.

Goals of the Science Seminar Series include providing students an opportunity

- To see real-world applications of their coursework
- To meet professionals working in the biological sciences
- To see a variety of career options.

Beginning in 1990, students were encouraged to arrange the seminars under the guidance of a faculty advisor. For the Spring 1996 semester, students will work with Associate Professor Snitovsky to plan and implement the Science Seminar Series.

Professor Sundberg is a member of the Northern California Society of Anatomists. This group is composed of anatomy teachers from community colleges and meets to address anatomy and physiology education.

Professor Wodehouse and Associate Professor Snitovsky are working on a habitat restoration project on the northwest corner of the campus for the endangered Mission Blue Butterfly.

The Biology Department at Skyline College was a founding member of the San Mateo County Biotechnology Education Partnership (The Gene Connection). The Gene Connection was designed to bring supplies and equipment to high school science classrooms. In 1989, the Partnership consisted of the County Office of Education, Aragon High School, Menlo-Atherton High School, Westmoor High School, and Genentech, Inc. Funding was provided by the Genentech Foundation.

Professor Wodehouse is the Tech-Prep liaison for the SMT Division. He works with high-school teachers throughout the State on applied biology/chemistry curricula and locally with faculty at Jefferson High School to develop a Career Path in health sciences.

The Biology Department at Skyline College was a founding member of the Bay Area Biotechnology/Education Consortium. The Consortium was funded by the State Chancellor's Office and Professor Case was appointed as its Director. The Bay Area Consortium was designed to verify and refine employment projections, develop a skills inventory for techniques, and increase industry awareness of community colleges. This project was the model for the California Biotechnology Education Consortium; Skyline College is a member of the new Statewide Consortium.

San Mateo High School has begun a Biotechnology Tech-Prep program. Professor Case is on their advisory committee. The High School anticipates graduating their first class in Spring 1996 and would like these students to continue their biotechnology studies at Skyline College.

Associate Professor Snitovsky, Professor Wodehouse, and Professor Case are regular judges for the San Mateo County Science Fair and Bay Area Science Fair.

Skyline College was a founding member of the Partnership in Biology Education Conference. Annually, the conference brings 150 biology instructors from Northern California community colleges, CSU, and UC together to discuss issues in biology education. Professors Case and Wodehouse have served on the steering committee for this conference and the conference has been held at Skyline College.

Expanding Your Horizons (EYH) is a conference for 6th through 12th grade girls in San Mateo County. We have applied for and received funding for this conference annually since 1980. The current funding agent is the Genentech Foundation. Professor Case and Associate Professor Snitovsky co-chair the 1995 and 1996 EYH conferences. This conference brings over 100 scientists, engineers, mathematicians, and health care professionals to Skyline College for one

day in March. Our students volunteer to assist in the planning and implementation of this conference. The students work with us to ensure a successful event for over 800 girls. In addition, our students meet and form personal contacts with professionals in the biological sciences.

Biology lab technician Patricia Carter assists students in open lab and frequently helps the instructor provide individual attention during lab. She was instrumental in helping local high schools begin doing experiments with DNA and genetic engineering (see *The Gene Connection*, p. 17). She provides assistance to teachers who have completed the Summer Institute In Microbiology and Biotechnology (see p. 16). Additionally, Ms. Carter has made professional presentations at *Expanding Your Horizons* and the Council of Math Science Educators of San Mateo County.

During this Program Review:

1. The Biology Faculty reaffirmed our commitment to the GE guidelines developed by the SMT Division (Appendix A).
2. With the Counseling Division, we reviewed our A.S.-degrees in Natural Science, Allied Health Science, and Biotechnology.
3. Established a Department Policy for credit for Advanced Placement (AP) Biology courses. In light of rising costs at UC and CSU and changes in admissions policies, it is likely that more students completing the AP test with scores ≥ 3 will attend a community college. We have initiated contact with CSM and Cañada College to develop a district-wide policy.

• **Needed development activities**

In addition to the major developments listed above, the Biology Faculty have large numbers of students and high weekly student contact hours. This means that faculty are reading weekly or biweekly lab reports in addition to writing and reading exams and other student papers. Most of the following "needed activities" cannot be done without additional support from the College.

1. **Development of existing courses.** We need faculty to develop BIOL 130 and 108 or a related field experience.
2. **Lab equipment to keep lab classes current with technology and knowledge.** For example, PCR is included in newspapers and other lay reading because of recent publicity using PCR to isolate 40-million-year-old DNA and to identify sources of blood at crime scenes. Someone taking a college general biology or majors course should have more information than just Court TV and have hands-on experience with PCR. At present, our students have used PCR because instructors have been able to arrange one-time-only loans of the necessary equipment from friends.
3. **Biotechnology.** We have a degree program in Biotechnology and are ideally situated both geographically and politically to develop a certificate program and additional courses. At present we do not have the staff time or College commitment to pursue development.

Advisory committees. (a) At present, one faculty member, teaching full-time, is trying to develop this program including high school, university, and industry articulation. (b) The San Mateo High School advisory board meets during regular class hours which precludes Skyline's presence at the meetings.

4. **Another follow-up of transfer students.** In 1987 we undertook and completed a follow-up study of Skyline Science Majors (1969—1986) (7). A follow-up of science students (post 1986) should be done by 2000.

5. **Multi-media delivery.** Biology 101 was developed to provide an opportunity for students to complete their lab requirement with flexible scheduling. Studies have shown that Biology 101 students show a difference in achievement over students in conventional nonmajor courses and, more importantly, students say they couldn't take a lab class without the flexible schedule (4, 5).
6. **Develop topical and interdisciplinary courses.** Biology provides a natural place for special-topics courses such as the biology of cancer and emerging diseases and interdisciplinary courses on a wide range of topics including biotechnology and society, the politics and economics of alternative energy, and nutrition science. Although the Biology Faculty have a high degree of interest in such offerings, we are all teaching full loads offering our existing courses.

B. Recruitment and orientation of new faculty, staff, and student workers.

Announcements for regular faculty positions are sent to most community college Districts in California and to four-year universities in Northern California. Additional announcements for staff and part-time faculty positions are placed in newspapers in San Francisco, San Mateo, Santa Clara, Alameda, and Contra Costa Counties. Additionally, we call the Biology Departments at local universities so they can post our announcements.

Our policy is that Hiring-Committee members make a commitment to mentor and assist new faculty members. Part-time faculty are mentored by the lead instructor (a full-time person who also teaches that course). We have one staff position, Biology Lab Technician, in the Department. Our policy is that the technician and faculty are a team whose job is to provide the best possible learning environment for students. As laboratory techniques in the Biological Sciences advance and are incorporated into classes, faculty provide encouragement and opportunities for the technician to master these techniques. Recent examples include DNA analyses. Ms. Carter was encouraged to participate in a project involving County high schools, San Francisco State University, and Skyline College. Ms. Carter was a key member of this project and quickly developed expertise in RFLP techniques. Another example is the use of PCR in BIOL 230. The introduction of this 1993-Nobel-prize winning work changed biology for all time and Ms. Carter is becoming proficient using PCR.

Student tutors, lab assistants, and stockroom assistants are recruited from successful and interested students. BIOL 101 student lab assistants are trained by Professor Case and Ms. Carter. Ms. Carter also trains the stockroom assistants. Tutors are trained by Felix Perez in The Learning Center.

VI. FACILITIES, EQUIPMENT, MATERIALS AND MAINTENANCE

A. *How effectively do the facilities, equipment, their maintenance and the materials available to this program support current and projected program needs? How do they affect student success? Are they accessible to all students, including the disabled?*

- We have only three laboratories. One lab. can only be used for General Education courses, one lab is specifically designed for anatomy and physiology, and one lab can be used for Majors. Lab time is scheduled for lab classes, lecture classes, and open lab hours; unscheduled time before and after classes is essential for maintenance and to set-up and undo classroom supplies. These labs cannot accommodate any additional classes. Because of this, some students cannot enroll in the Biology classes they need in order to complete their educational goals. This problem was recognized by the College in 1993 and plans to build additional laboratories in Building 7 were developed (Vocational/Technical Training Addition). As some classes are moved to Building 5, we may be able to move lecture classes out of labs to make more lab time available.
- Scientific equipment has been a limiting factor for the past six years. Biology requires equipment and the equipment needs are increasing with technologic developments in the biological sciences. When a piece of equipment breaks, we don't have a duplicate for back-up and must wait, sometimes as long as a year for a replacement. We have been fortunate that, so far, this has *only* been inconvenient. Loss of certain pieces of equipment would stop classes. When we have only one piece of equipment to be shared by a class of 30, students must wait to use it. Moreover, we have not been able to plan on having an equipment budget and timely purchase of new equipment.
- A chronic shortage of supplies means that students must sometimes work in larger than desirable groups or that they cannot repeat an experiment. For the first time in many years, we had an adequate supply budget for the 1994-95 academic year. However, with the increase in number of students, the inclusion of DNA labs in BIOL 110 classes, and inflation, the need still exists for additional increases in the supply budget.
- None of the biology labs has a low lab bench required for wheelchair-bound students. We have been making-do by bringing a table as needed. This arrangement does not provide a sink or gas jet and one lab (7303) does not have space to safely set a table.

B. *Are any special uses of technology made in your program? Is your program current with respect to the use of technology compared to that made in similar programs at other community colleges? Is the use of technology current compared to that made in four-year institutions and in business/industry?*

Biology requires a great deal of discipline-based technology. We have used microscopes, centrifuges, and spectrophotometers for many years. Recent advances in the biological sciences have raised the requirements for technology. We now need high speed centrifuges, microtube shakers, and electrophoresis gel boxes and power supplies in general education courses; thermalcyclers, bioreactors, and computerized gel readers in majors courses; and ELISA readers and physiographs in Allied Health Science. We have managed to stay abreast of four-year schools so our students are prepared for transfer. We are one of six community college in Northern California and the only college in the SMCCCD where students can do RFLP analysis and PCR. The former is not necessarily a great accomplishment as many high schools are currently using RFLP and PCR and all high schools are being encouraged to incorporate these laboratory experiments into their curricula, and these students will soon be entering college (12).

Communications and multi-media technology are also used in biology:

- We have introduced computers into the Allied Health Science and Majors programs. We have two computers for student use. A Macintosh in one lab and a donated Apple II+ in another lab. Students have to spend valuable lab time waiting to use a computer.
- All college students need to learn how to access information through the Internet. Four-year schools expect this of their students. It is common practice for Biology classes at four-year schools to require students to pick up assignments and participate in discussions on a college-managed listserver. The advantages to this include (1) reduced paper flow and (2) students can ask questions, and get answers, while they are studying rather than waiting until class meets again. At four-year schools, students are required to get and return assignments via E-mail. Our students will be transferring at a disadvantage if they do not have this experience before reaching their junior year. As one university president put it "A world without E-mail and listservers is unthinkable" (3).
- A video microscope is used in BIOL 250 and BIOL 260. The video microscope allows high-quality image projection on a large TV so students can become familiar with tissue and cell types they will need to identify in their independent lab work.
- BIOL 101 provides an alternative format for students to fulfill their General Education laboratory requirement (6, 14) and is ideally positioned to use the new instructional technology as we enter the 21st century (15). Slide-tape modules were the technology of the 1970s when we began auto-tutorial instruction. This format is problem-laden and dated. Due to budgetary constraints, we have not progressed to videotape and CD ROM as have other schools.

If students are to use multi-media in the manner they were intended, i.e., to provide the maximum flexibility in scheduling, a laboratory needs to be open for their use. We have managed to maintain an open laboratory for 11 to 19 hours per week. Students often ask for other hours including Saturday and evening hours. However, we have not been able to accommodate students to the fullest extent because of impacted laboratory facilities and lack of funds to staff the lab. To date we have alternated faculty with the Biology Lab Technician and student assistants. For several years, The Learning Center has provided the student assistants but we do not have any formal agreement to continue this arrangement. Moreover, their ability to provide student assistants is dependent on The Learning Center's funding.

- Video-disks are increasingly available free with adoption of textbooks. In order to take full advantage of video-disks, the video-disk player must be mounted in the classroom. Faculty must be able to practice locating desired frames and must be able to use it quickly in class.
- Due to lack of space, we must use laboratories for lecture classrooms. Because of fixed seats and poor acoustics, laboratories are not conducive to lectures, discussions, and the use of any type of audio-visual equipment.

C. If appropriate, how effective is the support your program receives from industry?

Although we do not have an advisory committee, personal contacts with industry have been used to get equipment and supplies for the program. We borrowed RFLP and PCR equipment to include these experiments in BIOL 230. Novo Nordisk donated a bioreactor so our students could learn bioprocessing techniques.

Through personal contacts we have been able to place students in internships, normally reserved for seniors, after their sophomore year. Students have had paid summer internships at Biosys, Genencor, and Terrapin.

VII. BUDGET REQUEST

Between 1991 and 1994, Biology generated an average of 5.7% of the College's WSCH and received an average of 3.6% of the College budget (17). In order to provide students with the classes they need, we have increased the number of sections offered by 32% and the number taught by part-time faculty by 600%. Moneys allocated to Biology for equipment and supplies have not kept up with the demands of increased numbers of students and increased costs. Our budget request will allow us to catch up in staffing and equipment and supplies. The requested budget is essential to maintain our high enrollments and quality courses.

- Staffing**
- Two full-time tenure-track positions
 - Upgrade the Biology Lab Technician to Instructional Aide

Facilities We need classroom, lab, and study-room space. Some space in Building 7 could be given to Biology with the opening of Building 5. The need for space was recognized by administration in 1993. It is imperative that we proceed with the Vocational/Technical Training Addition Proposal developed by the administration in 1993.

Equipment A minimum annual equipment budget is essential to maintain and upgrade scientific equipment. We have on-going equipment needs as new techniques are developed. New and, as yet, unforeseen developments in the biological sciences must be included in the classroom. Additionally, we must be able to replace or repair old and/or broken equipment at the time it is needed \$30,000

Projected needs for the 1996—97:

Video Support Table.....	600	Thermalcycler.....	\$4500
Dissecting kits, 15@\$20 ea.....	300	Vertical gel boxes	4500
Incubator	3200	Gel reader	4150
Evolutionary agents.....	100	Micropipettes, 20@\$200 ea	4000
Video disk player.....	500	Deskwriter printers, 2	600
Refrigerator	500	Skull, charts & Auditory ossicles.....	631
Microscope repair/upgrade.....	4000	Ophthalmoscope	300
Fluorescence microscope.....	9000		

Special Needs When the autoclave breaks BIOL 230 and BIOL 240 will not be able to do *any* lab experiments and other courses will not be able to perform certain lab experiments. An "autoclave fund" must be maintained to ensure *immediate* replacement of the autoclave when necessary:..... \$40,000

Student assistants We need student assistant funds to pay tutors to help students in lab and outside of class. BIOL 101 tutors (20 hr/wk); BIOL 250/260 tutors (20 hr/wk); BIOL 110 tutors (8 hr/wk).

Computers Our students need access to computers in labs and study rooms. "Paperless classes" wherein teachers and students communicate via E-mail and class notes and assignments are distributed via the Web are becoming increasingly common at four-year schools. Our students will be transferring at a disadvantage if they cannot easily navigate the Internet. Moreover, Biology majors need to be able to communicate with the larger community available through the Internet.

- 20 Macintosh Power PCs
- 5 - 10 printers depending on how the computers are deployed
- Internet access for the computers and E-mail accounts for Majors

Supplies The supply budget must reflect rising prices and our current enrollment. Annual supply budget.....\$16,500

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APPENDICES

APPENDIX A. Report of the SMT General Education Review Subcommittee

At the behest of the Ad Hoc General Education committee that each division meet and review its entire curriculum in the light of specific guidelines, a representative committee was established by the Science/Math/Technologies/Division. The following represents, formulated with much care and deliberation, the subcommittee's evaluation, general philosophy and recommendations regarding that specific element of general education termed "Natural Science."

Within the broad scope of the vague Ad Hoc Committee guidelines, there is the necessity of grappling with a more precise operational definition of "Science," as well as the further question of what constitutes a "Science Experience" in a student's overall education. At fundamental issue is the uniqueness of such an experience. Upon introspection and examination, one finds that the common feature of all scientific endeavor is the organization and expansion of knowledge by systematic investigative means, and that this feature is characteristic of true science regardless of subject area of nature.

Upon considering science more as an intellectual process rather than merely a comprehensive subject area of data, it is the committee's collective judgment that artificial distinctions of specific discipline areas, such as physical science, life science or earth science, is neither necessary nor desirable. Indeed, to draw such strict distinctions would be to negate the possibility of valid cross-disciplinary courses which could not conveniently fall within the realm of a single category.

In order to come to some operational conclusion about the meaning of science as a part of General Education, more defined criteria and objectives are required. A "Science Experience," especially in terms of a one-time educational opportunity for a non-science major, requires that a student at least be able to understand if not indeed use the underlying investigative methods of science. To best accomplish the overall desired objectives of such a "Science Experience," the following criteria were developed to define what is the best and most valid science experience offerable in the overall concept of general education.

1. The subject material should be of sufficiently broad nature as to provide the student with a scope of information which will help develop within the student the ability to objectively deal with the events and responsibilities of daily life
2. "SCIENCE" should be taught as an intellectual process of problem solving — and the development of the common elements of logic used to solve problems scientifically. The student should be required to participate in scientific endeavor rather than function merely as the passive recipient of information gained by past scientific discoveries.
3. The student should be provided with a realistic picture of science as a process whereby man explores his environment and should be acquainted with the role of science as a powerful social and intellectual force in society.

Utilizing the broad criteria of the Ad Hoc Committee as well as the aforementioned refined criteria of "Science" in particular, an evaluation of each class offering within the SMT Division has been undertaken. Such analysis has been painstakingly undertaken, utilizing course outlines, stated course objectives, course descriptions, textbooks, and any other information available to the subcommittee. Based upon this careful and lengthy evaluation, the following courses are considered to meet G.E. requirements:

Astronomy 10	Meteorology 1
Biology 3, 4, 7, 11, 20, 21, 22, 23, 25	Oceanography 10
Chemistry 1a, 1b, 12a, 12b	Physical Science 10
Geology 1a, 1b, 10	Physics 2a, 2b, 4a, 4b, 4c, 10

Since the course list is based upon the role and function of science as an area of student enrichment, there is no rationale for distinguishing specific course differences for CSU transfer certification and Skyline AA certification. As the lists would be based upon the same criteria, the analysis is the same in both cases.

Upon careful consideration, it is the recommendation of the SMT General Education Subcommittee that G.E. transfer certification require the completion of two courses from the Natural Science list, preferably within different catalog headings.

Scientific problem solving requires cultivation like any other intellectual skill, but also involves the common use of concrete test elements — tools. Indeed, the actual experimental processes of scientific investigation usually involve physical manipulation within something of a "Laboratory Environment." Such an environment need not always fit the classical concept of an equipment filled room, but may indeed be any physical facility where measured quantitative and qualitative investigation is functionally possible. The opportunity to actually perform meaningful experiments, to come into contact with the actual materials of which lecture concepts are formed, and to physically as well as intellectually participate in scientific discovery is an important part of a college student's overall education. In response to this importance, it is the opinion of the subcommittee that, of the two Natural Science courses undertaken to fulfill CSU General Education Certification, one be a laboratory science.

Taken together, the design of Natural Science courses applicable to G.E. should place a considerable emphasis on science as an approach to knowledge as well as a body of organized knowledge. Such an increased emphasis on the epistemology of science is not an attempt to supplant scientifically derived information with an abstruse examination of things "scientific," but rather to permit the student to participate in the dynamic aspect of science — the process of discovery. If a student has a realistic and critical picture of science and he is armed with an understanding of the attitudes and approaches which characterize science, he will be better able to function as a thoughtful and intelligent member of society. While the sub-committee's evaluation of existing course offerings necessitated a binary "yes" or "no" conclusion, any and all courses should do with introspection and reevaluation of objectives, especially in terms of general education.

In an effort to complete its assignment in a reasonable amount of time, the committee was conscientious in sticking to the immediate issues. Although we did have some discussions about curriculum design, teaching strategies, and the implementation of our recommendations, we believe these are considerations which require everyone's participation. Some broader concerns which we believe require your attention are:

1. Regularly scheduled offerings dealing with the processes of scientific discovery utilizing the physical sciences are limited.
2. There are certain "areas" of scientific thought which are not currently represented that perhaps should be represented.
3. Laboratories designed with general education objectives in mind seem to be scarce, especially at the "less sophisticated entry levels" of many of our students.
4. Current offerings tend to emphasize the traditional fragmented approach to knowledge and problem solving. Considering the underlying common elements of scientific investigation and problem solving, there is no reason to believe that introductory cross-disciplinary offerings could not be offered by interested instructors whenever participation and facilities are available.

SMT Division
October 1979

APPENDIX B. Animal Use in Science Laboratories

Given our philosophy that the study of science is best facilitated through hands-on investigation, Skyline College supports the principle that the use of animals in teaching is an essential pedagogical device for investigating certain biological phenomena. All animal use will be in accordance with Federal and State laws. When considering the use of animals, faculty are encouraged

- to explore whether the learning objectives of the investigation can be met without the use of animals;
- to clearly communicate to students how the use of animals in the lab is necessary to fulfill objectives;
- to be conservative in using animals;
- to refrain from using threatened or endangered species in any laboratory exercise;
- to properly train students and technicians in the handling and care of animals.

Biology Dept.
October 1993

APPENDIX C. Biology Laboratory Safety Guidelines

Biosafety

1. Eating, drinking, smoking, storing food, and applying cosmetics are not permitted in the laboratory.
2. Work surfaces are disinfected at the beginning and end of every lab period and after every spill.
3. Mechanical pipetting devices are used; mouth pipetting is prohibited.
4. Place a disinfectant-soaked paper towel on desk while pipetting.
5. Wash your hands after every laboratory exercise. Bar soaps may become contaminated, therefore, liquid or powdered soaps should be used.
6. Cover spilled microbial cultures with paper towels and squirt disinfectant on towel. Leaves for 20 minutes then clean up the spill. Do not touch broken glassware with your hands, use the broom and dustpan. Broken glassware contaminated with microbial cultures or body fluids are placed in the To Be Autoclaved container. (See the other side of page for broken glassware that is not contaminated.)
7. Glassware and slides contaminated with microorganisms, blood, urine, and other body fluids are placed in disinfectant.
8. Gloves should be worn when touching blood and body fluids.
9. Hands should be washed immediately and thoroughly if contaminated with blood or other body fluids.
10. Work only with your own saliva, blood, urine, tears, and other secretions and excretions.
11. Wear safety goggles when working with blood.
12. Tie long hair back.
13. Don't do unauthorized experiments.
14. Don't use equipment without instruction.
15. Horseplay will not be tolerated in the laboratory.

Specific Hazards

Alcohol

Keep containers of alcohol away from open flames. When it is necessary to heat alcohol, pour alcohol into a heat-resistant container and heat on a hot plate.

Glassware

If you break a glass object, sweep up the pieces using the broom in the lab. Do not pick up pieces of broken glass with your bare hands.

Broken glass is to be placed in one of the containers marked for this purpose. The one exception to this rule concerns broken thermometers; consult your instructor if you break a thermometer.

Electrical equipment

The basic rule to follow is electricity and water don't mix. Do not allow water or any water-based solution to come into contact with electrical cords or electrical conductors. Your hands should be dry when you handle electrical connectors. If your electrical equipment crackles, snaps, or begins to give off smoke — do not attempt to disconnect it. Call your instructor immediately.

Fire

If gas burns from a leak in the burner or tubing, turn off the gas.

If you have a smoldering sleeve, run water on the fabric.

If you have a very small fire, the best way to put it out is to smother it with a towel or book (not your hand). Smother the fire quickly.

If a larger fire occurs, such as in a waste basket or sink, use one of the fire extinguishers in the lab to put it out. Your instructor will demonstrate the use of the fire extinguishers.

In case of a large fire involving the lab itself, the room and building should be evacuated according to the following procedure:

1. Turn off all gas burners and unplug electrical equipment.
2. Leave the room and proceed

3. It is imperative that you assemble in front of the building so that your instructor can take roll to determine if anyone is still in the building. Do not wander off.

First aid

1. Report all accidents immediately. Your instructor will administer first aid as required.
2. For spills in or near the eyes, use the eyewash.
3. For large spills on your person, use the safety shower.
4. For heat burns, the affected part should be chilled with ice as soon as possible.

Power outage

If the electricity goes off, be sure to turn your gas jet off. When the power is restored, the gas will come on.

Earthquake

Turn off your gas jet and get under your lab desk during the temblor. Your instructor will give any necessary evacuation instructions.

Orientation walkabout

Locate the following items in the lab:

Broom and dustpan
Eyewash
Fire blanket
Fire extinguisher
First aid cabinet

Fume hood
Instructor's desk
Reference books
Safety shower
To Be Autoclaved Area