COLORADO STATE UNIVERSITY

INSTITUTIONAL RESPONSE TO

THE PROGRAM REVIEW CONDUCTED BY THE

BIOLOGICAL SCIENCE AND PHYSICAL SCIENCE INTERDEPARTMENTAL PROGRAMS

FOR THE YEARS

1978-1983

PREPARED BY THE OFFICE OF

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Interdepartmental Programs

College of Natural Sciences

DESCRIPTION OF THE INSTITUTIONAL REVIEW PROCESS:

A full description of the institutional review process is on file in the Office of the Commission on Higher Education. Essentially the process is the same for all program reviews conducted at Colorado State University: (1) A Departmental committee conducts a self-evaluation; (2) the self-evaluation report is received by the Department Head and the Dean; (3) an off-campus group of consultants is sometimes invited to review the self-evaluation and to analyze the operations of the Department, but such groups are not always used; (4) a review team composed of administrators and faculty from other Colleges and Departments of the University reviews the report to establish its comprehensiveness and cogency; (5) the report and all responses to it are reviewed by the Graduate Dean and Academic Vice President; (6) the Academic Vice President prepares an institutional response to the self-evaluation report, making use of all the responses to it; (7) the institutional response is discussed with the self-evaluation committee, Department Head, Dean, and Graduate Dean; (8) the State Board of Agriculture reviews and approves the institutional response; and, finally, (9) the institutional response is filed with the Colorado Commission on Higher Education and is used to assist in internal planning.

PROGRAM OBJECTIVES:

The College of Natural Sciences offers two interdepartmental programs in the natural sciences: 1) The Bachelor of Science in Biological Science, and 2) the Bachelor of Science in Physical Science. These two programs constitute a central part of the University's continuing efforts in broadbased, liberal arts education. The participating faculty believe that these programs now and in the future will have a vital role in helping to prepare young people for meaningful lives in an increasingly complex society. The education provided must be broadly multidisciplinary, seeking to integrate the contributions from the sciences, arts, and humanities into a functional synthesis that contributes directly to the development of informed citizens capable of making critical choices.

The two programs differ in their basic orientation, one toward the physical sciences and the other toward the biological sciences. In all other respects, they are quite similar. No faculty or other resources have been assigned specifically to these programs, with the exception of a portion of the time of the Assistant Dean of the College of Natural Sciences who also serves as the Director of the Biology Core Curriculum. Actually, these two interdepartmental programs derive their vigor and relevance from the involvement of faculty members from the various Departments who teach the courses and provide the advisement to students. The Departments will offer the courses whether the two programs exist, since the courses provide the basic and advanced instruction in the biological and physical sciences. By offering the two programs, the University makes available to students the opportunity for a broad -- but not general -- education in the sciences rather than the traditional disciplinary education. The two programs have

existed at the University for several years and have served the students well. The two programs seek:

1. To provide to interested students a broad and interdepartmental education in the biological and physical sciences, encompassing all areas of knowledge and emphasizing the integration and synthesis of knowledge and the development of appropriate skills;

2. To prepare students for careers as science teachers in the public schools;

3. To provide opportunities for students to prepare themselves for advanced graduate or professional work in the sciences or science-related fields;

4. To provide service to all majors across campus, especially with regard to course development in the sciences;

5. To maintain programs relevant to the changing demands and needs of students in a modern and increasingly technological society;

6. To provide leadership in the University effort to maintain the University Studies Program of liberal education; and

7. To provide service to the College, University, and community.

ANALYSIS AND ASSESSMENT:

In the remainder of this report, the two programs will be treated separately so as to avoid confusion and simplify the analysis and assessment of each program.

B.S. in Biological Science

The University initiated the B. S. in Biological Science in 1955 as an option within the interdepartmental major in Natural Science (offered along with the interdepartmental majors in Social Science and Humanities by the College of Science and Arts). In 1957, the College separated the Natural Science major into the two distinct majors that have existed since that date. The Biological Science major "provides a broad background in the biological sciences and permits concentration in areas of particular interest." Because of its breadth and flexibility, combined with its rigor, the major serves particularly well as the program of choice for persons interested in teaching in the public schools or pursuing advanced work in graduate or professional schools.

As mentioned, the Assistant Dean of the College of Natural Sciences administers the program and draws advisers from the participating Departments of Biochemistry, Botany, and Zoology, or, in some instances, from Departments outside the College of Natural Science. In addition, the Pre-Med Adviser also interacts with those students who select this major as the means to prepare for medical, dental, or other health-professional school.

The approved curriculum requires of all majors a minimum of 40 credits in the biological sciences; 19-22 credits in the physical sciences (including a year of chemistry, with laboratory, and physics, with laboratory); 4-7 credits in biochemistry; 8 credits in mathematics, including calculus; 4 credits in communication skills development; 12 elective credits in humanities and social sciences; 2 credits in physical education; and a sufficient number of free electives to meet the 128 credit graduation minimum. Those students aiming for teaching careers or for professional schools can qualify themselves through the judicial use of electives.

The 40 credits in the biological sciences must include a year of freshman biology and designated courses in cell biology, developmental biology, genetics, and ecology. Moreover, the student must select at least 12 of these credits from one specific field of concentration, with a minimum of one course from each of two additional fields. Because of the breadth of offerings in the biological sciences at Colorado State University, students find little difficulty in developing comprehensive but structured programs.

In addition, students can opt for any one of three concentrations within the Biological Science major: General Biology, Biochemistry, and Animal Biology. General Biology has remained the most popular of these concentrations, although the other two have existed for a much shorter period of time. The catalog statement explains the differences among the three concentrations:

> The animal biology concentration offers a plan of study for students wanting emphasis in animal biology that stresses broad principles from cellular biology to ecology. The biochemistry concentration is

oriented toward those students interested in the chemical basis of living systems and provides a strong physical science background integrated into the biological science major. The general biology concentration offers students a broadly based study of biology.

The Biological Science major has become one of the largest in the University in terms of the number of majors. On the average from 1968 through 1982, the major included roughly 433 students annually. Approximately 80 entering freshmen opt for the major every year during PREVIEW CSU. In addition, several students elect to change into or out of the major each year. As a result, the University has graduated about 50 students each year with the Biological Science major. These graduates have varied career objectives, ranging from teaching in the public schools to military service. However, the vast majority of graduates go into teaching or attend graduate and professional schools. Quite clearly, the major has served its intended purpose.

The enrolled majors represent a cross section of the student population of the University. Credentials identify some as among the outstanding graduates each year. Of course, still others exemplify the average. While relatively few have come from minority groups, nonetheless the program does offer an attractive vehicle to those minority students wishing to pursue graduate or professional education.

As mentioned earlier, the program has no resources dedicated exclusively to it. The faculty come from the participating Departments and teach the courses for majors within the Departments as well as to meet the needs of other majors across the campus. The relatively small commitment of time

from the Assistant Dean and the larger commitment of the academic advisers would be required whether the major exists or not. Thus, it appears quite clear that the existence of the Biological Science major satisfies the needs and aspirations of a large group of students without imposing additional demands upon scarce resources.

Library holdings and facilities serving this program relate more specifically to the participating Departments and to the Biology Core Curriculum. That is to say, the Library holdings and the facilities are needed whether or not the program exists. Thus, to provide opportunities to the students by making use of resources committed for other reasons makes very good sense.

The major fits well within the role and mission of Colorado State University as a land-grant institution with the responsibility to maintain instructional programs in the scientific and technical fields. Moreover, the program provides a rigorous, broad-based, and flexible course of study meeting the needs of a very large group of students. Finally, at very low cost, the program fulfills its intended purpose of preparing graduates for teaching careers, advanced study in graduate and professional schools, and for meaningful lives in the modern and technological society of today. As such, the program merits continued support.

B. S. in Physical Science

The baccalaureate program in Physical Sciences began as an option within the major in Natural Science offered by the College of Science and Arts in 1955. In 1957, it became a separate and distinct major and has served the needs of interested students well since that date. Administered by the

Assistant Dean of the College of Natural Sciences, the program consists of courses in the physical sciences offered by the participating Departments to meet the needs of their majors and to serve other majors across the campus. Faculty members from Departments in the physical and mathematical sciences within the College serve as advisers to the Physical Science majors, with the Assistant Dean assuming the coordinating role.

The major "provides a broad background in the basic physical sciences and an intensive program in two fields of physical science of the student's choosing. Properly designed programs can qualify students for admission to professional studies in legal and health related fields or graduate studies in the basic or applied sciences." Specifically, the major requires the students to complete 40 credits in the physical sciences; 9 credits in mathematics, including calculus; 6 credits in the development of communication skills; 36 credits in the biological sciences, humanities, and social sciences, with a minimum of 8 credits in each area; and 2 credits of physical education. Within that framework, the students must complete core courses in chemistry, mathematics, and physics and select two fields for minors from among biochemistry, computer science, geology, mathematics, physics, or statistics. The courses in the biological sciences must form a coherent program of study. Finally, the students select free electives to fill out the 128 credits required for graduation.

The most popular minors selected by majors over the years have been chemistry, mathematics, and physics. However, several students have selected minors from all the allowed fields. Rigorous yet flexible, the major offers to interested students the opportunity to explore the physical sciences and to develop an understanding of the interrelationships that

exist. As a result, the major serves those students well who seek to synthesize knowledge drawn from a variety of fields in preparation for challenging new opportunities in the future.

Nonetheless, the major has not attracted large numbers, accounting for only about 64 enrolled students annually. Over the five year period, a total of 322 students enrolled in the major at one time or another. Very few entering freshmen select the major, although larger numbers of students transfer into it after having been on campus a few semesters. Undoubtedly, some of the students who come to the major do so after having tried other majors and found them unrewarding; in addition, others select the major when they cannot gain entry into high demand areas in engineering, computer science, geology, and related fields. Approximately 14 students graduate annually in the Physical Science major. While small, the program clearly responds to the needs of a group of students who might otherwise not attend the University.

The Library holdings and other facilities are adequate for the maintenance of this program, since the program relies upon learning materials, faculty, and facilities available within the College generally and the several participating Departments. In addition, the programs impose little burden on the College or the Departments, except with regard to administrative costs and those have been kept to a minimum. The College has maintained careful records over the years in the effort to assure an adequate foundation for appropriate revision.

Students who select the Physical Science major prepare themselves for a variety of careers. However, roughly half of the graduates of the program

planned to pursue advanced study in graduate or professional schools. That statistic speaks well for the rigor as well as the viability of the program. Of the 23 indicating such plans, 14 followed through by gaining admission to graduate and professional schools and one additional graduate entered a program to secure a second bachelor's degree. Moreover, 18 of the 46 graduates are in graduate or professional school, employed in a health professional field, or employed in a physical science field. The large majority of students feel that the program prepared them well in terms of their aspirations.

The enrolled majors represent a cross section of the student population of the University. Credentials identify some as among the outstanding graduates each year. Of course, still others exemplify the average. While relatively few have come from minority groups, nonethless the program does offer an attractive route to those minority students wishing to pursue graduate or professional education.

As mentioned earlier, the program has no resources dedicated exclusively to it. The faculty come from the participating Departments and teach the courses for majors within the Departments as well as to meet the needs of other majors across the campus. The relatively small commitment of time from the Assistant Dean and the larger commitment of the academic advisers would be required whether the major exists or not. Thus, it appears quite clear that the existence of the Physical Science major satisfies the needs and aspirations of a respectable group of students without imposing additional demands upon available resources.

The major fits well within the role and mission of Colorado State University as a land-grant institution with the responsibility to maintain instructional programs in scientific and technical fields. Moreover, the program provides a rigorous, broad-based, and flexible course of study meeting the needs of a significant group of students. Finally, at very low cost, the program fulfills its intended purpose of preparing graduates for teaching careers, advanced study in graduate and professional schools, and meaningful lives in the modern and technological society of today. As such, the program merits continued support.

PROGRAM PLANS:

Planning for the future of these two degree programs at Colorado State University requires attention to several related developments. The University faces very real and immediate challenges in terms of resource development and must make decisions soon about priorities and future directions. The natural sciences have been traditional fields of study at Land-Grant colleges and universities since the latter half of the nineteenth century. During the latter part of the 20th and into the 21st century, scientific study will assume an even greater importance. The very great attention paid to technological needs and imperatives, with the resultant concern for scientific and technological literacy within the society so as to assure continued competitiveness, indicates that majors of this kind will increase in popularity as public awareness of the needs and challenges increases.

More specifically, the President has announced the intent to guide Colorado State University toward becoming one of the leading research universities

in the country. Success in that endeavor will require the support, assistance, and cooperation of the entire faculty. Specifically, the faculty in all Departments will need to enhance the record of performance in scholarly and creative endeavor. Quite clearly, there is a pressing need to accord greater emphasis to this important area of concern, while also taking care to sustain the most responsive and up-to-date instructional programs.

In addition, the University recently approved a proposal to broaden the University requirements for graduation. All Colleges and Departments have a vital stake in the success or failure of this endeavor, since the University must insure that all students have the opportunity for an education characterized by breadth as well as depth to prepare them for meaningful lives in a modern, technological society. The Biological Science and Physical Science majors serve that purpose well, as the record of the past five years reveals. Moreover, the faculty involved in offering the courses to support these programs have gained valuable experience in providing what is required to assure that students are educated appropriately for life in the 21st century.

On the basis of these considerations, program plans for the Biological Science and Physical Science interdepartmental majors can be outlined in brief:

1. In view of the current cost-effectiveness and significant student demand for the Biological and Physical Science interdepartmental majors, the College intends to continue these programs.

2. However, the College will consider alternative organizational arrangements for the Biological Science major. This major serves a large number of students who would benefit from more formal associations with one or more Departments. Plans for reorganization will consider the need for periodic review of the curriculum by knowledgeable faculty.

3. The University and the College will consider alternative administrative arrangements to more closely integrate the Biology Core instructional program with the Biological Science major.

4. The College will conduct, during the next two years, a systematic survey of graduates in the Biological Science major to provide additional insight for organizational changes.

5. The College will initiate efforts to assure that interested students become familiar with the two programs and their rigor and flexibility. In addition, the efforts will include measures designed to enhance the diversity of the students who select the two majors.

6. The College of Natural Sciences, through the Assistant Dean and faculty committees, will work closely with the Office of the Provost/Academic Vice President to develop detailed plans assigning specific tasks to appropriate agencies, individuals, and groups for implementation of these program plans during the next two years.