

Five-Year Review  
(1978-1983)  
of the  
Interdepartmental Major in  
PHYSICAL SCIENCE

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## INTRODUCTION AND HISTORY

This document represents the first five year review undertaken for the interdepartmental major in Physical Science. The program was initially termed the "Major in Natural Science" with options in Biological Science and Physical Science. The major in Natural Science along with majors in Social Science and Humanities were three interdepartmental majors that were administered by the School of Science and Arts (pp. 150-157, Colorado A & M College Bulletin, 1955-1957). The general description of the three interdepartmental majors at that time was: "These majors permit the student to obtain a bachelor's degree in a general field with a broader course of study than is usually permitted for a departmental major. They also offer broad basic training for many persons who plan to continue their education in graduate or professional schools" (p. 150, Colorado A & M College Bulletin, 1955-1957). The Physical Science option "permits a wider selection of courses in basic and applied subjects than is permitted in one of the physical sciences. This option provides for selection of courses in Chemistry, Geology, Mathematics and Physics, along with a beginning course in Astronomy" (pp. 151-152, Colorado A & M Bulletin, 1955-1957). The major in Natural Science was divided into two separate majors, the major in Biological Science and the major in Physical Science in 1957 in the School of Science and Arts (pp. 155-157, Colorado A & M College Bulletin, 1957-1959). Since the establishment of the College of Natural Sciences (CNS, 1968) the major in Physical Science has been administered by the dean's office of CNS. While faculty in a number of physical and mathematical science departments have served as advisers, the vast majority of advising has been done by the key adviser in CNS and advisers in the Department of Physics.

## CURRICULUM

The curriculum of the major in Physical Science currently "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 graduates for admission to professional studies in legal and health related fields or graduate studies in the basic or applied sciences" (p. 145, CSU Bulletin, 1982-1983). While the description and purpose of the program has remained essentially unchanged since its origin in 1955, several minor changes in curricular requirements have occurred since that time. At the start of the five year review period (Academic year 1978-1979), the curricular requirements allowed students to "select courses from any of the physical sciences while pursuing one or more in depth. The 20 credit requirement in one field plus 20 diversified credits in related fields gives students a choice along with a base for advanced study in an area of concentration" (p. 148, CSU Bulletin, 1978-1979). The major "check-sheet" (Item I, Appendix) indicates a requirement for 40 credits in physical sciences, 9 in basic mathematics, 6 in communication skills, 12 in biological sciences, 12 in humanities, 12 in Social Sciences, and 2 in physical education, in addition to upper division and free elective



requirements for graduation. In 1981, core courses in chemistry, mathematics, and physics became required and students had to complete the requirements for two minors from the fields of biochemistry, chemistry, computer science, geology, mathematics, physics and statistics (p. 141, CSU Bulletin, 1981-1982; check-sheet, Item II, Appendix). The communications skills requirements were altered slightly to conform to course changes in the composition and speech areas. The total required credits (36) in biology, humanities, and social sciences were unchanged but a minimum of 8 credits in each area was required including at least 9 upper division credits in one area. The biological science courses are expected to form a coherent course of study.

The Physical Science curriculum conforms to the proposed purpose of the program and yet, provides flexibility so that related areas in the physical science can be combined. The extensive requirements in the biological sciences, humanities, and social sciences ensure educational enrichment as the students pursue specific courses that may be required for certain professional schools (eg., medical school).

Students in the Physical Science major select a variety of minors or areas of concentration. Information based on available exit surveys of students who intended to graduate in the five-year review period indicate that of 46 students choosing minors or areas of concentration, they most frequently chose chemistry while biochemistry and statistics were the least frequently chosen (Table 1).

Table 1. Minors or areas of concentration chosen by graduates during the five-year review period.

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<u>Minors or Areas of Concentration</u>	<u>Number of Times Selected</u>
Biochemistry	1
Chemistry	19
Computer Science	3
Geology	4
Mathematics	9
Physics	9
Statistics	1
<b>TOTAL SELECTIONS</b>	<b>46</b>

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#### ENROLLMENT INFORMATION

Relatively few students have enrolled in the major in Physical Science. During the five year review period, the number of students initially declaring their intention to major in Physical Science at Preview CSU has been 23 with the largest number declaring during the Summer of 1980 (Table 2). It is difficult to explain the spurt of interest in the major in 1980 given the lack of additional information.



Table 2. Number of students declaring the Physical Science major at Preview CSU.

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<u>Year (Summer)</u>	<u>Number of Students</u>
1978	2
1979	3
1980	14
1981	3
1982	1
TOTAL	23

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During the five-year review period, the number of all students enrolled in the major in Physical Science at the time of the fall term head-count totals 322 students.

Table 3. Number of students enrolled in the Physical Science major (Fall head-count).

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<u>Year</u>	<u>Number of Students</u>
1978	85
1979	55
1980	62
1981	55
1982	65
TOTAL	322
YEARLY AVERAGE	64

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This number is much larger than would be expected given the low initial interest that students show toward the major at Preview CSU. Since the number of students attending Preview CSU during the five year review period represents approximately 70% to 80% of the entering freshman class, one would expect that fewer students would be enrolled across all 4 years than are indicated in Table 2. Several explanations can be proposed for this apparent anomaly given the limited information available. One of the explanations might be that many of the students entered CSU in an undecided category (including students in prehealth professions programs) and changed to the Physical Science major after entry. A second explanation is that some students, in attempting to gain entry to certain popular controlled majors (eg., Engineering, Computer Science, Geology), decided to enroll in Physical Science. A third possibility is that students originally enrolled in programs in engineering, mathematics, physics, computer science, geology, chemistry, and other physical sciences who encountered difficulties in their chosen major and decided to change majors, sought a suitable major that would allow them to complete degrees with little additional time added to their college careers, and declared the Physical Science major.



The number of students graduating with degrees in the physical science major during the five-year review period is shown in Table 4.

Table 4. Number of physical science major degrees conferred during the five-year review period.

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<u>Year</u>	<u>Number of Degrees</u>
1979	28
1980	16
1981	7
1982	13
1983	7
TOTAL	71
YEARLY AVERAGE	14

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The average number of degrees conferred each year during the five-year review period represents 22% of the average number of students enrolled each year in the Physical Science program during that same period. While it may be difficult to predict the "appropriate" percentage of graduates based on the number of students enrolled in a given major, the percentage of graduates in Physical Science do not seem inordinately low nor exceedingly high. As a comparison, during the same five year review period, the yearly average number of graduates in the interdepartmental major in Biological Sciences represented 11% of the average number of students enrolled in the major at the fall term head count. Whether the use of these data in this fashion represents a valid measure of the demand for a program, its "utility", "raison d'etre", "value", "desirability", etc., can be argued. Certainly, comparisons with other programs might be useful if no less valid.

#### CAREER OBJECTIVES OF PHYSICAL SCIENCE MAJORS

Graduation with a B.S. degree in Physical Science can provide employment in identifiable professions; however, most vocations and professions for which the breadth, depth, and blending represented by this program are appropriate generally require either graduate study or specialized professional education. Some career objectives for physical science majors include graduate study, entry into a health professional school, and employment in industry or government. An exit survey of 46 students asking for their plans after graduation indicated that at least half of the students planned to enter professional school or graduate school (Table 5).



Table 5. Student career intentions prior to graduation during the five-year review period.

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<u>Intentions after graduation</u>	<u>Number Selecting Intention</u>
Professional School	12
Military Service	3
Graduate School	11
Get a job	16
I don't know	4
TOTAL	46

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While 26 of the students responding had definite plans upon graduation, 20 of the 46 did not have a specific intention of what they were going to do after they graduated. Whether this response is typical of many graduating students regardless of the field is not clear but more complete and standardized survey methods would be necessary in order to obtain meaningful comparative data.

CAREER ACCOMPLISHMENTS OF PHYSICAL SCIENCE GRADUATES AND PERCEPTION OF THE MAJOR

A mail survey of 47 graduates in the five year review period resulted in a response (mail-back) of 30 graduates (61.7%). A copy of the survey letter is included in the appendix (Item III). Table 6 indicates the responses and frequency of responses to the question: "What is your area of employment or status at the present time?".

Table 6. Employment status of students graduating during the five-year review period.

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<u>Employment Status</u>	<u>Frequency of Response</u>
Military	5
Graduate School	1
Second Bachelor's Program	2
Medicine (school, internship, residency)	9
Dentist	3
Veterinary School	1
Salesperson	3
Health Physicist	2
Computer Operator	2
Secretary	1
Manager	1
TOTAL	30

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Obviously, the career achievements of the respondents vary considerably. However, 18 of the respondents are in graduate study, health professions (or in training), or in a physical science area.

Table 7 indicates the response and frequency of response to the question: "Did the Physical Science major sufficiently prepare you for your present employment?".

Table 7. Response of students graduating during the five-year review period regarding adequacy of preparation for present employment.

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<u>Adequate Preparation</u>	<u>Frequency of Response</u>
Yes	18
No	7
I don't know	5
TOTAL	30

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Based on the responses, 60% of the respondents felt sufficiently prepared for their current employment or training status by majoring in Physical Science.

Table 8 indicates the response and frequency of response to the question: "If you had to do it over again, would you major in Physical Science?".

Table 8. Response of students graduating during the five-year review period regarding selection of Physical Science major "if they had to do it all over again".

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<u>Select Physical Science</u>	<u>Frequency of Response</u>
Yes	20
No	10
TOTAL	30

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Based on these responses, 66% of respondents would major in Physical Science if they had to do it over again. Of the 20 "YES" respondents, some added additional comments, which are of some interest (Item IV, Appendix). Of the 10 "NO" respondents, the alternative majors and their frequency of selection as shown in Table 9.



Table 9. Alternative majors selected by graduates that would not major in Physical Science "if they had to do it all over again".

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<u>Alternative Major</u>	<u>Frequency of Selection</u>
Electrical Engineering	1
Business	2
Chemistry	1
Computer Science	1
Animal Science	1
Biological Science	1
Art Education	1
More Specific Major	2
TOTAL	10

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Based on the above responses, the graduates (in hindsight) would have selected a variety of majors including some far removed from the physical science area. However, except for Art Education and Business, most students would have selected majors in science or engineering.

From this "non-scientific" survey, one could conclude that the Physical Science major satisfactorily served the needs of a majority of the graduates who responded.

#### SUMMARY AND CONCLUSIONS

Some of the more important summary points and conclusions regarding the interdepartmental major in Physical Science are as follows:

1. The major has been in place at CSU since 1955. Its general description has changed little in the 28 years of its existence.
2. There have been changes in some of the curricular requirements since the inception of the major. The most notable of these are of a recent vintage (ca. 1980-1981), resulting in a required core of mathematics, chemistry and physics courses and a requirement for two minors from Biochemistry, Chemistry, Computer Science, Geology, Mathematics, Physics, and Statistics. There was an upgrading of requirements in the biological sciences, humanities, and social science credits by requiring a cohesive plan of courses in the biological sciences and a requirement for at least 9 upper division credits in one of the three areas.
3. The curriculum is perceived as rigorous but flexible and can allow students to select several appropriate combinations of minors and to provide enrichment of their college training by a relatively large number of required credits in the biological



sciences, humanities, and social science areas. The flexibility and rigor of the program allow for a range of career objectives.

4. Students do not elect to major in Physical Science upon entry to CSU. Enrollment figures over all four years (based on Fall term head count) suggest that students move into the major, probably for several reasons. The number of graduates in Physical Science has varied through the five-year review period but, on average represent about 22% of yearly enrollments over the same period.
5. Student career intentions prior to graduation vary considerably but appear to be consistent with the stated purpose of the major.
6. Student career achievements after graduation vary considerably but the majority of careers appear to be consistent with the stated purpose of the major.
7. At least 60% of graduates felt sufficiently prepared for their career choices by majoring in Physical science. Two-thirds of the graduates would major in Physical Science if they "had it all to do over again", suggesting relative satisfaction with the major.

#### RECOMMENDATIONS

Since the interdepartmental major in Physical Science is a program that:

1. is appropriate in the context of the mission and purpose of Colorado State University,
2. has a rigorous and flexible curriculum that provides more than adequate training for the career objectives of its students,
3. serves the needs of a modest number of students who perceive the program as a useful major,
4. has produced a number of satisfied graduates in varied careers and professions for which the program was designed,
5. is administered without any apparent expense and at low cost involving minimal administrative and faculty commitment,

the committee recommends that:

1. the program be maintained in its present form and that the Dean's Office of the College of Natural Sciences continue to administer the major and provide advising services for students in the program,



2. a systematic and complete survey of the students and graduates served by the major be conducted in the next review period to ensure that the need for the program continues.
3. a review of the program be conducted regularly within the program review cycles of the University.



APPENDIX

- Contents:
- Item I. Major Check Sheet, 1978
  - Item II. Major Check Sheet, 1981
  - Item III. Mail Survey Questionnaire Sent to Graduates, 1984
  - Item IV. Summary of Responses to Question 3 of Mail Survey

