Science and Math — Interdisciplinary

College of Science and Mathematics
Kin-Ping Wong, *Dean*
Science Building, Room 136
(559) 278-3936

B.A. in Natural Sciences

Biotechnology Certificate

Single Subject Teaching Credential

Science and Mathematics

The primary goal of the College of Science and Mathematics is to provide professional training at the undergraduate and graduate levels. To achieve this goal, our programs of study serve as foundations for careers in science and mathematics. They provide professional training in preparation for careers in medicine, dentistry, pharmacy, veterinary medicine, and other professions.

The college consists of the departments of Biology, Chemistry, Earth and Environmental Science, Mathematics, Physics, and Psychology. Degree programs are listed separately. The college provides study for students in the areas of biology, chemistry, geology and environmental science, mathematics, physics, and psychology by offering courses in the majors; support courses for non-science majors such as agriculture, engineering, and the health professions; and courses for the general education of all university students.

The college requires faculty members to possess the appropriate terminal degree recognized in their discipline. The college has 90 permanent faculty members; all hold the doctoral degree in their discipline. Doctorates held by faculty were granted by some of the most prestigious universities in the nation and abroad. Furthermore, students and faculty members conduct research and scholastic activities in their academic areas as well as solve applied scientific problems of the region. This research activity is carried out among campus scientists along with investigators at other regional research centers.

The College of Science and Mathematics also is collaboratively involved with the school systems in science/mathematics teacher education. Important emphasis is placed on the recruitment, retention, and education of underrepresented minorities and females in science and mathematics majors.

The College of Science and Mathematics and the United States Department of Agriculture (USDA) — Agricultural Research Services (ARS) have a cooperative agreement to service and promote the Natural Sciences Scholars Program (NSSP). The NSSP provides scholarships and research experiences to encourage minority and disadvantaged students to enter USDA research related professions.

The USDA Forest Service Partnership is designed to bring together existing and new community resources to increase college enrollment and graduation of Hispanics and other minority and disadvantaged students in natural resources and related fields.

Bachelor of Science degree in Environmental Sciences

This special interdisciplinary program leads to a B.S. in Environmental Sciences jointly conferred by California State University, Fresno and the UC, Riverside. Qualified students admitted into this program are concurrently registered at both universities but pay student fees *only* to the campus where they are in residence. There are minimum residence requirements by both universities. Students can take courses at both campuses in person or through distance learning. The B.S. in Environmental Sciences has three degree options: (1) Earth Sciences, (2) Life Science, and (3) Behavioral, Policy, and Health Sciences. The curriculum is designed to provide an interdisciplinary education in life, physical, or social sciences directed towards the understanding and the solution of today's environmental problems. For further information call Dr. John Suen, Earth and Environmental Sciences Department, (559) 278-7888 or (559) 278-3086.

Math and Science Teacher Education

The college offers baccalaureate degree programs in mathematics and natural sciences that serve as subject matter preparation programs leading to the Single Subject Teaching Credential in Mathematics and Science. In science, a student can select the Single Subject Teaching Credential with an emphasis in Biology, Chemistry, Earth Science, or Physics. For more information, call Agnes Tuska (Math Education) at (559) 278-2992 or Dave Andrews (Science Education) at (559) 278-2412.

Humans and the Natural Environment (HNE)

(18-unit thematic cluster)

A cluster of intensive field courses is presented at the introductory level. Concurrent registration in the four courses listed in this section is required. Fifteen of the 18 units of credit are applied to General Education requirements. This course of study (fall semester only) involves approximately one month of instruction in various field locations with significant time in several of the locations. A special fee of $300 is charged for transportation and food on field trips. For further information, contact the dean's office at (559) 278-3936.

BIOL 15 An Ecological Approach to Life Science (5)
GEOL 15 The Earth and Its History (5)
NSCI 15 Environmental Science (3)
SSCI 15 Humans in the Natural Environment (5)

Biotechnology Certificate Program

The college offers a one-year postbaccalaureate Certification of Advanced Study in Biotechnology. This intensive program of study emphasizes molecular biology and a wide range of laboratory skills at the forefront of modern biotechnology. The certificate program can lead to potential careers in expanding fields such as: drug and hormone production in the pharmaceutical industry, monoclonal antibody production for medical diagnostics, crop improvement, industrial bioprocessing, and medical research. The program also provides a strong background for advanced studies in biochemistry, molecular biology, and agricultural biotechnology. For further information, call Howard Ono (Chemistry) at (559) 278-2103 or Shirley Kovacs (Biology) at (559) 278-2001.

Marine Science

The college offers a Master of Science degree in Marine Science in cooperation with Moss Landing Marine Laboratories. The program at Moss Landing provides extensive field and laboratory work for advanced study to prepare students for careers as marine specialists, scientists, and teachers. For further information, call the Biology Department at (559) 278-2001.

Preprofessional Programs

Preprofessional programs are available for students who plan to transfer to other institutions for the completion of professional curricula in such fields as medicine, veterinary medicine, dentistry, pharmacy, optometry, and chiropractic. For further information call:

Premedical
Lenore Yousef ..... (559) 278-2001
Predental
Fred Schreiber ..... (559) 278-2001
Preveterinary
Frederick Zechman ... (559) 278-2001
Prepharmacy
Howard Ono ..... (559) 278-2001
Preoptometry
Parameswar Hari ..... (559) 278-2371
Prechiropractic
Raymond Abhold ..... (559) 278-2001
Preosteopathic
Francisco Pineda ..... (559) 278-4748

Bachelor of Arts Degree Requirements

Natural Sciences Major

The Bachelor of Arts degree in Natural Sciences serves as a subject matter preparation program for the single subject teaching credential in Science. With the Science Credential, you are able to teach any introductory science class, i.e. earth, general, life, or physical science along with the courses in your chosen emphasis. For additional information, see the listing under the Biology, Chemistry, Earth and Environmental Science or Physics departments or see the B.A. in Natural Sciences credential coordinator, David Andrews, at (559) 278-2412.

Units

Core requirements 37
Biology[1] ..... (12)
BIOSC 1A, 1B, 130
Chemistry ..... (10)
CHEM 1A, 1B
Geology[1] ..... (8)
GEOL 1 and 3 (or 15), 168
Natural Science ..... (3)
NSCI 106
Physical Science ..... (4)
PSCI 21
Options (select one) 39-44
Biology ..... (42-44)
CHEM 8 or 128A ... (3)
PHYS 2A, 2B[2] ..... (8)
PSCI 168 or GEOL 155 ..... (3)
MATH 70 or 75 ..... (4)
MATH 101 or PSYCH 42 ..... (4)
BIOSC 140A, 140B, 180 ..... (10)
MICRO 140 ..... (4)
Select one course: BOT 131, 132, 144; MICRO 171; ECOL 151, 152, 162; ZOOL 120, 141, 148, 150, 174, 177 ... (3-4)
Select one course: BOT 130; MICRO 161; PHYAN 151, 163 ..... (3-4)
Chemistry ..... (39)
PHYS 2A, 2B[2] ..... (8)
PSCI 168 or GEOL 155 ..... (3)
MATH 75 ..... (4)
MATH 76 ..... (4)
CHEM 128A ..... (3)
CHEM 102, 108*, 128B, 129A, 155* ..... (17)
Earth Science ..... (44)
CHEM 8 or PSCI 168 ..... (3)
PHYS 2A, 2B[2] ..... (8)
MATH 70 or 75 ..... (4)
GEOL 12, 30, 100, 101, 102, 105, 112, 155 ..... (23)
Select two courses: GEOL 110, 114, 117, 124; GEOG 111 .... (6)
Physics ..... (44)
CHEM 128A ..... (3)
PSCI 168 ..... (3)
MATH 75, 76, 77, 81 ..... (16)
PHYS 4A, 4AL, 4B, 4BL, 4C ..... (11)
PHYS 102, 105A, 107A, 130 ..... (11)
General Education requirements 51
Electives and remaining degree requirements[3,4] 0-5
Total 120

Advising Notes for all Options within the Natural Sciences Major

1. GEOL 15 is part of the Humans and the Natural Environment Cluster. See the *Natural Science Interdisciplinary Courses* section in this catalog. GEOL 15 is equivalent to GEOL 1 and 3.
2. Substitutions may be made with the permission of the appropriate department chair. PHYS 4A-B-C with labs 4AL, 4BL is recommended instead of PHYS 2A-B for those students well prepared for physics.
3. This total assumes that students in this option will maximize the 12 units required for the major that also may be applied to fulfill General Education requirements as follows: CHEM 1A (3 units), BIOSC 1A (3 units), GEOL 168 (3 units) and, depending on emphasis and choice, MATH 75 (3 units). Consult your major adviser for details.
4. Students should be sure to take sufficient upper-division units in their General Education courses and electives to satisfy the graduation requirements of 40 upper-division units and Upper-division Writing Skills.
5. No physical science Integration B course may be used to satisfy the General Education requirements for majors in physical science.

* Offered fall semester only.

COURSES

Natural Science (NSCI)

1. The Art and Practice of Medicine (1; max total 4)
Primarily for prehealth care students. Delivery of health care today. Concepts of the art of medicine presented by community physicians and specialists. ***CR/NC*** grading only.

1A. Integrated Science: Physics and Chemistry (3)
Prerequisite: MATH 10A with a grade of *C* or higher. Integrated science: basic concepts and misconceptions in physics and chemistry and their relation to the everyday environment. Memorable demonstrations in lecture, household-related experiments, and experiments of special interest to K-6 teachers. (2 lecture, 2 lab hours) Meets G.E. B1 requirement only for liberal studies majors.

1B. Introductory Earth and Life Science (4)
Prerequisite: N SC 1A. General principles of earth science and biology with an emphasis on subjects appropriate to K-6 teacher training. Applications to everyday experiences are emphasized. (3 lecture, 2 lab hours) Meets G.E. B2 requirement only for liberal studies majors.

4. Science and Nonsense: Facts, Fads, and Critical Thinking (3)
Use of language, thought, and logic in science, distinguishing science fact from science fiction. Inductive and deductive

methods, judgment, opinion, belief, and knowledge. A critical examination of contemporary pseudoscientific issues (creation "science," UFOs, astrology, etc.) G.E. Foundation A3.

15. Environmental Science: An Integrative Course (3)
Concurrent enrollment in BIOL 15, GEOL 15, and SSCI 15 required. Portion of *Humans and the Natural Environment* Cluster. A study of the interrelationships among the anthropological, biological, and geological aspects of man/woman and the natural environment. Team taught. ***CR/NC*** grading only. (HNE program field trip fee, $300)

40T. Topics in Natural Sciences (1-4; max total 12)
Prerequisite: permission of instructor. Interdisciplinary topics covering such subject matter areas as environmental studies and the impact of science on society.

100 and 100S. Chemistry for Liberal Studies (3)
Not open to engineering students. Prerequisites: NSCI 1A and 1B. Emphasizes chemistry as a process rather than a collection of facts, laws, theories, and content in California K-8 Science Standards. Designed especially for students planning careers in K-8 teaching. S sections include a service-learning requirement.

101. Biology for Liberal Studies (3)
Not open to engineering students. Prerequisites: NSCI 1A and 1B. Emphasizes biology as a process rather than a collection of facts, laws, and theories. Designed especially for students planning careers as elementary school teachers.

102. Physics and Astronomy for Liberal Studies (3)
Not open to engineering students. Prerequisites: NSCI 1A and 1B. Introductory physics and astronomy with emphasis on hypothesis formation, analysis, and testing. Everyday observations and materials will be used to the extent possible to facilitate the transfer of concepts and techniques to the elementary classroom. (2 lecture, 2 lab hours)

106. Reigning Theories of Science (3)
Examination of historically important scientific theories from the perspective of science as a human enterprise. Role of philosophy, religion, culture, and nationalism in the acceptance/rejection of theories. Research paper, class presentation required.

110. Practicum in Medicine (2)
Prerequisite: permission of instructor. Offered in association with the UCSF Fresno Medical Education Program. Premedical students assigned in one or more clinical settings in the community. Emphasis on in-depth association with health professionals for clinical observation and biomedical research experience. (Spring semester)

115. Environmental Earth and Life Science (3)
Prerequisites: G.E. Foundation and Breadth Area B. Environmental problems related to population, energy and resource use, and pollution. Examines social and ethical issues along with technological and scientific factors. Independent work on case studies required. G.E. Integration IB.

116. Energy, Technology, and Society (3)
Not open to engineering students. Prerequisites: NSCI 1A and 1B. Examines the role that chemistry, physics, and technology play in our society. Designed especially for students planning careers as elementary school teachers.

120. Biotechnology and Its Impact on Society (3)
Prerequisites: G.E. Foundation and Breadth Area B; courses in biology and chemistry (high school or college) strongly recommended. Introduction to the tools of modern biotechnology including recombinant DNA, gene therapy, cloning, monoclonal antibodies, DNA fingerprinting, and the Polymerase Chain Reaction (PCR). Addresses applications of biotechnology to medicine, agriculture, the environment, and forensics, as well as their ethical implications. G.E. Integration IB.

121. Blood: Science, Art, and Folklore (3)
Prerequisites: G.E. Foundation and Breadth Area B; courses in biology and chemistry (high school or college) strongly recommended. Introduction to blood — its unique chemical, physical, and biological properties and its importance in medicine and forensics. Explores the significance of blood images for artistic and religious symbolism in both contemporary and historical cultures. G.E. Integration IB.

125. Revenge of the Killer Microbes (3)
Prerequisites: G.E. Foundation and Breadth Area B; courses in biology and chemistry (high school or college) strongly recommended. Introduction to the adversarial relationships between disease-causing microorganisms and human affairs, both currently and historically. Explores the unique defense and counter defense mechanisms that have developed in a variety of microbes and the human immune system. Addresses health care issues related to disease prevention and control. G.E. Integration IB.

131. Biological Bases of Mental Illness (4)
Prerequisites: G.E. Foundation and Breadth Area B. Biological mechanisms which underlie various neurological disorders. Nervous system structure and function will be presented as a basis for understanding pathology. Topics include multiple sclerosis, Alzheimer's disease, Parkinson's disease, language disorders, depression, obsessive-compulsive disorder, and schizophrenia. G.E. Integration IB.

140T. Topics in Natural Sciences (1-6; max total 12)
Prerequisite: permission of instructor. Interdisciplinary topics covering such subject matter areas as medical technology and ecology. (May include lab hours)

180. Practicum in Secondary Science Teaching (2)
Concurrent enrollment in EHD 155B required; for single subject life/physical science student teachers. Application of best science teaching research; practice; emphasis on reflection/discussion of current teaching, effective management of students/time, authentic assessments, laboratory/curriculum resources, sheltered techniques, student motivators.

GRADUATE COURSE
Natural Science (NSCI)

240T. Topics in Natural Sciences (1-4; max total 8)
Prerequisite: permission of instructor. Interdisciplinary topics in the natural sciences at the graduate level covering such subjects as advanced techniques. Sample topics are *Radiation Techniques in Biology and the Physical Sciences* and *Recent Advances in Psychophysiology*. (May include lab hours)

IN-SERVICE COURSE
Natural Science (NSCI)

380T. Topics in Natural Sciences (1-4; max total 6)
Studies in the natural sciences integrating topics from biology, chemistry, geology, mathematics, physics, and psychology.