

# NATURAL SCIENCES AND MATHEMATICS, COLLEGE OF

**Dean:** Laura Kingsford

**Associate Dean for Academic Programs, Evaluation, and Advising:** Krzysztof Slowinski

**Associate Dean of Student Support:** Henry C. Fung

**Associate Dean for Research and External Support:** Kevin M. Kelley

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## Departments

### Biological Sciences

Brian T. Livingston, Chair (562) 985-4806

### Chemistry and Biochemistry

Christopher Z. Brazier, Chair (562) 985-4941

### Geological Sciences

Robert D. Francis, Chair (562) 985-4809

### Mathematics and Statistics

Tangan Gao, Chair (562) 985-4721

### Physics and Astronomy

Chuheee Kwon, Chair (562) 985-4924

### Science Education

Lisa Martin-Hansen, Chair (562) 985-4801

### CNSM Academic Advising Center

**Advisor:** Angela Tuan

Office: HSCI 164

Telephone: (562) 985-1587

### Jensen Student Access to Science and Mathematics Center

**Co-Directors:** Henry C. Fung

Office: HSCI 164

Telephone / FAX: (562) 985-4682 / (562) 985-5104

### CNSM Science Learning Center

**Director,** Jim McKibben

Office: HSCI 164

Telephone (562) 985-4841

## Introduction

The College of Natural Sciences and Mathematics (CNSM) provides quality educational opportunities in the life, physical sciences, and mathematics. Alumni of the College demonstrate that science and mathematics graduates are well-prepared to enter graduate and professional schools or to assume responsible positions in industry or government.

The College takes its responsibilities in teacher preparation in the sciences and mathematics very seriously. It participates in projects that provide a stronger, more rigorous, and more engaging set of teacher preparation programs at CSULB. There is funding from the National Science Foundation, NASA, and the Knight Foundation, and in collaboration with Colleges of Education and Liberal Arts, Long Beach Unified School

District, and Long Beach City College.

## Departments

Biological Sciences

Chemistry and Biochemistry

Geological Sciences

Mathematics and Statistics

Ocean Studies Institute

Physics and Astronomy

Science Education

## Programs at a Glance

Bachelor of Arts:

Chemistry, Physics

Bachelor of Science:

Biochemistry, Biology, Chemistry, Earth Science, Environmental Science and Policy, Geology, Marine Biology, Mathematics, Microbiology, Physics

Master of Science:

Biochemistry, Biology, Chemistry, Geology, Mathematics, Microbiology, Physics, Science Education, Statistics

Certificates:

Biotechnology

Minors:

Applied Mathematics, Biology, Chemistry, Geology, Physiology, Mathematics, Microbiology, Physics, Statistics

Single Subject Teaching Credentials:

Biological Science, Chemistry, Geosciences, Mathematics, Physics

## College of Natural Sciences and Mathematics' Academic Advising Center

All students are urged to participate in the Science Safari to Success (for first time freshmen) or EONS (Enrollment and Orientation in Natural Sciences and Mathematics) for transfer students. Programs offered each July (for those entering in August-September) and January (for those entering in January). A department advisor will be available to assist in developing an academic plan. During the semester, students may obtain academic advising by contacting the CNSM Academic Advising Center (HSCI-164) and/or appropriate advisor(s) in the department offering the chosen degree program.

The CNSM Academic Advising Center located in the Hall of Science, Room 164 (HSCI-164) collaborates with the College's undergraduate advisors to provide its majors with academic advising and support services so students can achieve their personal, academic, and career goals. Some of the services provided to CNSM majors include information and resources about academic programs; selection and sequence of courses; assistance with enrollment for courses; helping majors develop short- and long-term goals; assistance in navigating academic requirements, policies, and procedures; and providing appropriate referrals and career planning. The Academic Advising Center staff is available for appointments and some

walk-in assistance. Please contact the Academic Advising Center for more information.

### **Jensen Student Access to Science and Mathematics (SAS) Center and Programs Offered**

The Center (HSCI 164) is dedicated to promoting success for students who pursue majors in the College and those who take courses in its departments. It also facilitates several externally funded programs. The Center provides space for studying, tutoring, mentoring, computer access, and meeting sites for student-centered activities. The Center serves as the resource center for health profession advising, graduate school opportunities, and summer research opportunities and fellowships.

There are a host of activities and programs that strive to involve students and promote their success in science and mathematics. Several federally funded programs, the Center is dependent on external funding, focus on underserved students and address the diversity of our campus. In addition to fostering involvement of students in science and mathematics, they feature an ethnic identity that provides a unique encouragement for our science majors.

**MARC/RISE Programs.** The College hosts both programs funded by The National Institutes of General Medical Sciences: Minority Access to Research Careers (MARC) and Research Institute for Scientific Enhancement (RISE). Both programs have the goal of increasing the number and quality of students from specifically targeted groups/populations who pursue careers in scientific research. Students supported by these programs carry out state-of-the-art biomedical research projects in conjunction with a member of the faculty. MARC is an honors program (GPA 3.0) for upper division students, while RISE supports students as early as the freshman year and also upper division transfer students. As a result of their research activities, most students present papers at scientific conferences and often co-author publications appearing in leading scientific journals. MARC/RISE students are active in various outreach and mentoring activities.

**Beckman Scholars Program.** The program focuses on students who have the potential to achieve distinction in their academic fields. Support is provided for students working toward bachelor's degrees in chemistry, biology, or physics in the form of student stipends, laboratory supplies and funds for travel to appropriate scientific meetings. Students receive rigorous training by faculty members in a variety of techniques involved in nucleic acid research, protein biochemistry, biophysics, etc.

**Bridges to the Baccalaureate Program.** This program is funded by the National Institutes of General Medical Sciences and its goal is to provide historically underserved community college students with research opportunities in the biomedical sciences and to facilitate transition into baccalaureate and doctorate granting institutions.

**LS-AMP Program.** The College hosts the National Science Foundation's Louis Stokes Alliance for Minority Participation (LS-AMP) program. Its goal is to improve the mathematics and science preparation for historically underserved students majoring in the sciences, mathematics, and engineering and to enhance their

opportunities for graduate studies.

**Physics Teacher Education Coalition (PhysTEC) Program.** The CSULB PhysTEC Program, supported by the American Physical Society, National Science Foundation, and the CSULB's College of Natural Sciences and Mathematics, is a collaborative project between the Department of Physics and Astronomy, Department of Science Education, and the Teacher-in-Residence program recruited from local high schools. The PhysTEC Program aims to increase the number of physics majors earning teaching credentials at CSULB by actively recruiting, providing opportunities for early teaching experiences, and continuing the support structures for teachers at all levels. For additional information, please see <[www.physicsatthebeach.com](http://www.physicsatthebeach.com)>.

**Physical Science and Mathematics Scholarship Program.** The CSULB Physical Science and Mathematics Scholarship (PSMS) Program, funded by the National Science Foundation, is to increase diversity in the science, technology, engineering, and mathematics workforce and graduate studies. Qualified students are eligible for scholarships and access to best practices which contribute to student success and competitive applications for advanced studies. More information is available at [www.csulb.edu/psmscholarship](http://www.csulb.edu/psmscholarship).

**Science and Mathematics Enrichment and Peer Mentor Programs.** This program is designed to provide first time freshmen in the College of Natural Sciences and Mathematics with the guidance and personal support. The program assists students to enroll in classes appropriate for their major and background, provides them with enriched learning experiences, and peer role models during their first academic year. The Science and Mathematics Enrichment Program (SMEP) begins the week prior to the start of the fall semester. To be part of the program, students must be declared science or math majors. Peer mentoring provides students opportunities for tutoring to strengthen academic and communication skills.

**Honors in Biological Sciences.** This program was initiated by a grant from the Howard Hughes Medical Institute. Open to students with majors or career goals in the life sciences or related fields, it features an honors curriculum including courses in bioinformatics and research design as well as undergraduate research leading to a senior honors thesis and presentation at scientific conferences.

### **Health Professions Advising Office (HPAO)**

This office (HSC1-164) provides a wide range of advising and support services for students pursuing preparation and application to professional schools. The HPAO offers individual counseling, academic planning, application assistance, and many other resources designed specialty for students interested in medicine, dentistry, veterinary, pharmacy, optometry, podiatry, chiropractic, physician assistant, physical therapy, and graduate nursing.

### **College of Natural Sciences and Mathematics' Science Learning Center**

The CNSM Science Learning Center is located in Hall of Science, Room 110 (HSCI-110). This is a hands-on museum that houses many displays and exhibits from the College's six departments; Biological Sciences, Chemistry and Biochemistry, Geological Sciences, Mathematics and Statistics, Physics and Astronomy, and Science Education. The exhibits demonstrate concepts that are easier to understand through direct

physical involvement and personal discovery. Visitors are encouraged to turn the handles, push the buttons, and twist the knobs to enable the visitor's personal discoveries of science behind the display. These exhibits compliment the K-12 science curricula. The Science Learning Center also has a 27 foot Mobile Science Museum. Converted from a motor home into a hands-on laboratory, it makes visits to local schools, industry, and community events. Groups interested in visiting the CNSM Science Learning Center, or arranging for a visit by the Mobile Science Museum may contact the Science Learning Center for additional information (562-985-4841).

### **Student Research Opportunities**

Faculty members in the College involve more than 200 students annually, both undergraduate and graduate, in a variety of research activities. Many of these students are supported by research grants, especially during the summer months. Each year many of these students present the results of their research at scientific conferences. It is not unusual for a student to be an author on an article appearing in a major scientific journal.

Early each fall semester, the College, in collaboration with the Jensen Student Access to Sciences and Mathematics Center, hosts an Annual Research Symposium for students to present their findings of the research conducted in laboratories of CNSM faculty. The Symposium is open to members of the University and the greater Southern California community.

### **The Electron Microscopy Facility**

The study of the natural sciences requires observation of the macroscopic, microscopic, and sub-microscopic character of our universe. The College has a modern Electron Microscope (EM) Facility, utilizing a Joel-1200EXII transmission electron microscope (TEM), which is used by several undergraduate courses in addition to undergraduate and graduate research projects. The EM Facility also houses additional TEMs and an AMR 1000 scanning electron microscope has analytical capabilities.

### **Student Organizations**

The College of Natural Sciences and Mathematics Student Council sponsors annual events including the Nobel Laureate series and student-faculty-staff mixer. There are various social and academic-related programs that offer peer support, as well as opportunities for students and faculty to interact outside of the classroom.

Other student-led groups offer activities for students who are planning careers in one of the health professions (medicine, dentistry, etc.). The Organization of PreProfessional Students (T.O.P.P.S.) and Association of Pre-Dental Students (A.P.D.S.) have speaker series with representatives from professional schools; the group also holds social functions and provides a peer advising network. Chicanos/Latinos for Community Medicine (CCM) sponsors community outreach activities, an annual workshop on interviewing techniques, and an annual conference on applying to medical/professional schools.

### **Southern California Marine Institute (SCMI)**

The Institute operates a number of research vessels,

and provides the mechanism whereby students from CSU Ocean Studies Consortium campuses at Dominguez Hills, Fullerton, Long Beach, Los Angeles, Northridge, Pomona, San Diego, and San Marcos, as well as Occidental College and the University of Southern California can share courses and degree programs. In addition, Institute staff conduct research and facilitate the research of CSU faculty. The major focus is on harbors and coastal areas, with emphasis on environmental issues.

### **California Desert Studies Consortium**

CSULB participates in the California Desert Studies Consortium, which has a Desert Studies Center in the heart of the Mojave Desert at Soda Springs near the town of Baker. The surrounding area consists of typical Mojave Desert with dry lakes, sand dunes, and mountain ranges; it is the gateway to Death Valley and the Kelso Dunes. The Center has facilities for teaching field classes and for research. California State Universities at Dominguez Hills, Fullerton, Long Beach, Los Angeles, Northridge, Pomona, and San Bernardino are the Consortia members.

### **Institute for Integrated Research in Materials, Environment, and Society (IIRMES)**

IIRMES promotes and enhances educational and research opportunities for faculty, graduate and undergraduate students and the greater community at large. The major goals and accompanying benefits include research and scholarly activity; development of instructional programs to provide student training and research; and contribution to community service. IIRMES promotes cross-application of analytical techniques; facilitates access to state-of-the-art instrumentation for researchers; sponsors colloquia, lectures, and conferences; promotes interdisciplinary workshops and collaborations with other universities to create research possibilities for faculty and students; promotes educational programs and research opportunities for CSULB undergraduate and graduate students; provides analytical services for scientific community; and serves as a core CSU facility for elemental microanalysis.

### **CSUPERB Core Facility for Micro-Chemical Elemental Analysis (FEMCA)**

California State University Program for Education and Research in Biotechnology (CSUPERB) has created a core facility for elemental micro-chemical analysis (FEMCA). FEMCA's principal goal is to enhance the educational and research opportunities of students and faculty members in the CSU system who wish to pursue novel research in biotechnology. The facility builds on strong interdisciplinary ties between the biological, chemical, and physical sciences. FEMCA is housed within IIRMES for molecular and elemental analysis; scanning, transmission and atomic force microscopy; as well as purpose-built clean-room facilities for organic and inorganic extractions and sample preparation.

### **Center for Education in Proteomics Analysis (CEPA)**

A grant from the W.M. Keck Foundation and supplemental funds provided by the College of Natural Sciences and Mathematics at CSULB enabled purchase of an Applied Biosystems 4800 Matrix Assisted Laser Desorption Ionization, tandem Time of Flight Mass Spectrometer for protein and polypeptide analysis and identification. CEPA is part of

IIRMES' Facility for Elemental Micro Chemical Analysis (FEMCA), and is the only one of its kind in the USA that focuses on the use of this technology for undergraduate training and research.

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## Courses (NSCI)

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### LOWER DIVISION

#### 190A. Experience Success Program - 1 (1)

Prerequisite: Open to Freshman only.

Learn and adopt organizational time management study and test taking skills. Increase your awareness of science and mathematics related career options. Make connections with CNSM programs, resources, and people.

Letter grade only (A-F). (Seminar 1 hr)

#### 190B. Experience Success Program - 2 (1)

Prerequisite: NSCI 190A.

Explore science/math careers via job shadowing experiences and community based mini-internships. Learn about summer internship and research opportunities.

Letter grade only (A-F). (Seminar 1 hr.)

#### 191. Selected Topics in Natural Sciences and Mathematics (1-3 units)

Prerequisite: Lower division pre-major in Biology, Biochemistry, Chemistry, Geology, Marine Biology, Microbiology, or Physics

Specific topics of current interest in the natural sciences.

(Lecture 1 hr/unit). May be repeated to a maximum of 3 units with different topics in different semesters. Topics will be announced in the Schedule of Classes.

Letter Grading only (A-F)

#### 296. Introduction to Biomedical Research Methods (3 units)

Prerequisite: GE foundation requirements and consent of instructor.

Introduction to principles and ethics of experimentation, hypothesis formulation, and testing. Data measurement, analysis and presentation. Students will learn how to find and read scientific literature, keep a laboratory notebook and basic data graphing and analysis skills.

Letter grading only (A-F). Same course as ENGR 296. Not open for credit to students with credit in ENGR 296.

### UPPER DIVISION

#### 305. Origami in Science, Mathematics, and Education (3)

Prerequisites: GE Foundation requirements.

Hands-on instruction in the creation of origami works of fine art. Applications of folding materials in science, engineering, mathematics, and as a pedagogical tool in education.

(Lecture 3 hrs.)

#### 361. Scientific Research Communications (3)

Prerequisite: G.E. foundation courses; score of 11 or higher on the GEAR Placement Examination or successfully completed the necessary portfolio course that is a prerequisite for a GEAR Writing Intensive Capstone.

Introduction to technical writing for students pursuing research careers. Accessing and using research literature. Writing technical and research reports for various purposes and audiences. Oral presentation of research and scientific information. Includes intensive writing.

Letter grade only (A-F). Same course as HHS 361, CLA 361, and ENGR 361. Not open for credit to students with credit in HHS 361,

CLA 361, or ENGR 361.

#### 390. Experience Success Program for STEM Transfer Students (1)

Prerequisite: Open only to first semester transfer students with majors in CNSM or COE.

Learn to master time management, test taking skills, CV, professional statements and cover letter writing. Explore STEM careers. Learn about CNSM programs and opportunities which will support your professional growth.

Letter grade only (A-F). (Seminar 1 hr)

#### 490. Special Topics in the Natural Sciences (1-3)

Prerequisites: At least upper division standing in the College of Natural Sciences and Mathematics and consent of instructor.

Faculty and student discussions and analysis of a current topic in the natural sciences.

May be repeated to a maximum of 6 units with different topics. Letter grade only (A-F). (Lecture 1-3 hrs.)

#### 490L. Special Topics in the Natural Sciences, Laboratory (1-3)

Prerequisite: At least upper division standing in the College of Natural Sciences and Mathematics and consent of instructor.

Laboratory topics from selected areas of natural sciences.

Letter grade only (A-F). (Laboratory 2-9 hours).

#### 492. Internships In Natural Science (3)

Prerequisites: Major in the College of Natural Sciences and Mathematics, completion of 9 units of upper division science coursework, a 2.5 GPA overall or 2.75 GPA in the student's major, and consent of instructor prior to registration.

Qualifying students placed in a major or career-related assignment in private industry or at a public agency. May be placed in either a volunteer or paid work assignment. Teacher aide positions may be used for students interested in pursuing a career in science education in K-12 schools.

Learning assignments will be arranged through the Career Development Center and the instructor. Final written report required. Class attendance and internships to be arranged by the instructor. Minimum of 120 hours of field experience required. Credit/No credit grading only. May be repeated to a maximum of 6 units

#### 496. Advanced Behavioral Research Methods (3)

Prerequisites: ENGR 296 or NSCI 296, and HHS 361 or CLA 361 or ENGR 361 or NSCI 361, or consent of instructor.

An advanced study of the theoretical and practical aspects of conducting biomedical research including hypothesis formulation, experimental design, assessment of error within empirical data, and the preparation of sound and fundable grant proposals.

Same course as ENGR 496. Not open for credit to students with credit in ENGR 496

Letter grade only (A-F).

### GRADUATE LEVEL

#### 501. Project Management for Scientists (3)

Prerequisites: Consent of instructor. Not open to majors in the College of Business Administration.

Best practices utilized in scientific project management; includes project initiation, team dynamics, planning, scheduling, risk management, control, closure and evaluation. Applying gained knowledge to manage a project in their own scientific discipline. Offered in online or hybrid format.

Letter grade only (A-F). (Lecture 3 hrs)

### **502. Leadership and Management for Scientists (3)**

Prerequisites: Consent of instructor. Not open to majors in the College of Business Administration.

Prepares students entering science-related careers with a foundation in management skills. Fundamentals of leadership, teamwork, motivation, planning, and organizational strategy and structure are presented along with human resource management topics including performance management, recruitment and selection, compensation and employment law. Offered in online or hybrid format.

Letter grade only (A-F). (3 hours activity)

### **503. Accounting and Finance for Scientists (3)**

Prerequisites: Consent of instructor. Not open to majors in the College of Business Administration.

Introduction to concepts of accounting and financial management, focusing on scientific grants and contracts. Topics include: budgeting, planning and control; break-even, cost benefit and financial statement analysis; time-value of money; risk-return; capital and long term financing and investments. Offered in online or hybrid format.

Letter grade only (A-F). (3 hours activity)

### **504. Introduction to Regulatory Science (3)**

Prerequisites: Consent of instructor. Not open to majors in the College of Business Administration.

Introduction to legal and regulatory issues important in engineering, technology, and scientific activities in the pharmaceutical and medical device industries. Offered in online or hybrid format.

Letter grade only (A-F). (3 hours activity)

### **505. Professional Ethics (3)**

Prerequisites: Consent of instructor. Not open to majors in the College of Business Administration.

Introduction to the standards of professional practice and codes of ethics in the responsible conduct of scientific research. Course objectives fulfill the federally mandated requirements and professional standards for training in the area of scientific ethics and best practices. Offered in online or hybrid format.

Letter grade only (A-F). (3 hours activity)