

# College of Sciences

## Administration

Dean: Patrick J. Papin (Interim)

Associate Dean for Academic Affairs:

Associate Dean for Faculty Affairs: Catherine J. Atkins

Assistant Dean for Student Affairs: Estralita Martin

Director of Development:

## General Information

The College of Sciences, composed of eight departments and various subprograms, offers bachelor's, master's, and doctoral degrees, and curricula for preprofessional students in medicine, veterinary medicine, and dentistry. The science curriculum is enhanced by research centers which provide field experience as well as special seminars with guest speakers. The off-campus sites include the Mt. Laguna Observatory, and about 5,000 acres in four biological sciences research stations. The majority of tenured Sciences faculty have active research programs which offer student involvement.

## Curricula Offered

Refer to the Courses and Curricula section of this catalog for a complete listing of program requirements and courses offered by departments within the College of Sciences.

### Doctoral Programs

Biology (Cell and Molecular), Chemistry, Clinical Psychology, Computational Science, Ecology, Mathematics and Science Education

### Master's Degrees

Applied Mathematics (M.S.), Astronomy (M.S.), Biology (M.A., M.S.), Biomedical Quality Systems (M.S.), Chemistry (M.A., M.S.), Computational Science (M.S.), Computer Science (M.S.), Geological Sciences (M.S.), Mathematics (M.A.), Microbiology (M.S.), Physics (M.A., M.S.), Psychology (M.A., M.S.), Radiological Health Physics (M.S.), Regulatory Affairs (M.S.), Statistics (M.S.).

### Bachelor's Degrees

Astronomy (B.S.), Biology (B.A., B.S.), Chemical Physics (B.S.), Chemistry (B.A., B.S.), Computer Science (B.S.), Environmental Sciences (B.S.), Geological Sciences (B.S.), International Security and Conflict Resolution (B.A.; jointly with the College of Arts and Letters and the College of Professional Studies and Fine Arts), Mathematics (B.A., B.S.), Microbiology (B.A., B.S.), Physical Science (B.A.), Physics (B.A., B.S.), Psychology (B.A.), Statistics (B.S.).

### Minors

Astronomy, Biology, Chemistry, Computer Science, Energy Studies, Geological Sciences, History of Science and Technology, International Security and Conflict Resolution (jointly with the College of Arts and Letters and the College of Professional Studies and Fine Arts), Mathematics, Oceanography, Physics, Psychology, Statistics.

### Certificate Programs

Biotechnology, Communications Systems, Geographic Information Science, Mathematics Specialist, Professional Computational Science, Regulatory Affairs, Single Subject Mathematics.

### Other Curricula

Allied Health, Predental, Premedical, Preoptometry, Prepharmacy, Prephysician Assistant, Prepodiatry, Preveterinary.

## Research Centers and Institutes

### Edwin C. Allison Center for Earth System History Lindsey Leighton and Stephen Schellenberg, Co-Directors

Throughout the history of science, many of the critical breakthroughs in scientific understanding have resulted from cross-disciplinary research. The mission of the Allison Center for Earth System History is to foster this approach across the fields of paleontology, paleoclimatology, geochemistry, sedimentology, and organismal biology. The center seeks to facilitate research designed to improve and disseminate our understanding of global change and biodiversity, arguable the two most important topics facing current and future generations. Research materials of the co-directors and their students form the core of an in-house reference and systematics collection, including Cretaceous to Recent Ostracodes from globally distributed ocean drilling sites and Ordovician, Devonian, and Carboniferous brachiopods and associated communities from the Appalachian Basin, the Great Basin, the Ohio Valley, and the mid-continent. Scholarly examination of these and other materials by SDSU students, faculty, and guests (e.g. visiting students, faculty) are supported through dedicated research space and facilities, including image analysis, carbonate microsampling, and hydrodynamics flume systems. The Web site is <http://www.geology.sdsu.edu/facilities/allisonctr/>.

### Center for Behavioral and Community Health Studies (BACH)

John P. Elder, Director  
Terry L. Conway, Linda C. Gallo, Joni A. Mayer,  
and Gregory A. Talavera, Associate Directors

The Center for Behavioral and Community Health Studies (BACH) is housed at 9245 Skypark Court, Suite 221, San Diego, CA 92113. The center, formerly known as The Center for Behavioral Medicine, was established in 1982 for the purpose of promoting research and academic programs relevant to the applications of behavioral science principles to medicine and health care. The center has seven investigators from three different colleges. The interdisciplinary center encourages participation from all of the university colleges and departments. Currently, active investigators come from the Departments of Exercise and Nutritional Sciences, Psychology, and the Graduate School of Public Health. Current center projects involve collaboration between scientists and clinicians from a variety of specialties as well as a variety of other institutions, including Scripps Clinic and Research Foundation, the University of California, San Diego Medical Center, and the Children's Hospital and Health Center. Funding for the center comes from federal and private foundation grants including several National Institutes of Health agencies. Current sponsors include the National Cancer Institute, National Heart, Lung and Blood Institute, the State of California Department of Health Services, and the University of California Tobacco Related Disease Research Program.

The center provides important research experiences to diverse students who intend to pursue related careers and offers opportunities for project staff and graduate students to participate in community interventions. The Web site is <http://behavioralhealth.sdsu.edu/frontpage.html>.

### Center for Behavioral Teratology (CBT)

Edward P. Riley, Director  
Sarah N. Mattson, Associate Director

Teratology is the study of birth defects. The faculty and students at the Center for Behavioral Teratology (CBT) are interested in how prenatal exposure to various drugs influences both brain and behavioral development. Additionally, members of the center engage in research related to the general neurotoxicity of alcohol. The CBT is truly an interdisciplinary research organization, with a broad range of basic and

clinical research interests. While the primary purpose of the CBT is to promote research in teratology, personnel in the center also act as a resource to the university and the community. The staff provides in-service talks at local hospitals, schools, and drug treatment facilities, as well as lectures to various classes at the university. The CBT staff has active collaborations with faculty from UCSD, the VA Hospital, Children's Hospital, and the Scripps Research Institute. Faculty in the center have grants from the National Institutes of Health, Tobacco-Related Disease Research Program, and the State of California.

### **Coastal and Marine Institute** **Richard M. Gersberg, Director**

The Coastal and Marine Institute provides a focus for oceanography and marine studies at SDSU. The institute assists departments within the university in the development of instructional, research, and public service aspects of coastal and ocean-oriented programs and provides special supporting services including advising students, assistance to faculty and students in research, preparation of manuscripts, operation of the SDSU Marine Laboratories and boats, and liaison with other institutions and the community. The institute is operated as a special unit of the College of Sciences and is administered by a director and an advisory council committee consisting of faculty members elected from participating departments. Additional information about marine studies is available from the Coastal and Marine Institute office or from the office of the dean of the College of Sciences. The Web site is <http://www.sci.sdsu.edu/CMI/>.

### **Computational Science Research Center (CSRC)**

**José E. Castillo, Director**  
**Andrew L. Cooksy, Eugene A. Olevsky, Paul J. Paolini, and**  
**Faramarz Valafar, Associate Directors**

The Computational Science Research Center (CSRC) promotes the development and advancement of the interdisciplinary subject of computational science. This is accomplished by fostering research, developing educational programs, and promoting industrial interaction, outreach, and partnership activities.

The center provides an environment for scientific research at San Diego State University. It facilitates the interaction between applied mathematics, computer science, and other disciplines by providing the necessary infrastructure for productive research efforts. Real world applications are the focus of faculty and student projects. These projects provide an educational opportunity for students to hone industrially relevant computational skills.

The goals of the center are to encourage and facilitate research in computation, simulation, visualization, and numerical modeling in all disciplines (business and finance, biology and bioinformatics, engineering, physical sciences, and geography); to interact with other centers, laboratories, universities, and local industry; reduce lag time between algorithm development/analysis and applications; to participate in programs with other countries, including international programs sponsored by the National Science Foundation; to arrange visits by professors, including foreign visitors on sabbaticals and professional staff on industrial sabbaticals; to arrange part time and adjunct appointments for consulting activities by professional staff from local research laboratories; to provide employment, experience, and contacts for students; to sponsor conferences, workshops, and courses; to facilitate collaboration with government laboratories with private sector; to provide bridges to regional industry; and to direct the computational science program at San Diego State University.

Interested students and faculty may obtain more information by calling the CSRC office at 619-594-7205, <http://www.sci.sdsu.edu/csrc>.

### **Education Center on Computational Science and Engineering (ECCSE)** **Kris W. Stewart, Director**

The Education Center on Computational Science and Engineering (ECCSE) has supported and promoted the use of new computational tools in undergraduate instruction at SDSU and the California State University (CSU) since 1997. The main goal of the ECCSE is to better prepare learners for post-baccalaureate activities where collaborative

interdisciplinary teams, sophisticated computer tools, and effective communication are part of the research and problem-solving environment.

Funded in part by the National Science Foundation, the ECCSE represents the CSU system within the National Partnership for Advanced Computational Infrastructure (NPACI), one of only two National Science Foundation-supported high performance computing partnerships in the nation, involving research centers from across the United States and the world.

The ECCSE team of faculty educators, student developers, and education technology specialists accomplishes its mission by working closely with some of the world's leading computational scientists at the San Diego Supercomputer Center (SDSC), the 'Leading Edge Site' of NPACI. By providing a wide variety of education outreach projects, presentations, and training, the ECCSE is most valuable to faculty with a strong interest in broadening their undergraduate students' exposure to modeling, simulation, visualization, and high-performance computing resources in their specific discipline.

Education, outreach, and technology transfer play an important role in achieving the national goal of ensuring our leadership in advanced computing in the world. The ECCSE makes a valuable contribution to this effort by serving as an educator-friendly gateway to high-end computing and communications technologies. Through projects such as the ECCSE Faculty Fellows program, the Computational Science Olympics, and the Computational Science Resource Community, undergraduate faculty and their students gain valuable practical experience with some of the most advanced computational resources in the world. To learn more about the ECCSE, please visit our Web site at <http://www.edcenter.sdsu.edu>.

### **Center for Energy Studies (CES)**

**Alan R. Sweedler, Director**

The San Diego State University Center for Energy Studies (CES) facilitates, promotes and supports research and academic programs relating to energy, with particular emphasis on energy matters of concern to the San Diego and local southwest region including the international border with Mexico. The center encourages interdisciplinary research and instructional programs in the broad areas of energy modeling, technology assessment of energy systems, local energy policy planning and data collection relating to energy usage in the San Diego region. SDSU offers through the center an interdisciplinary minor in energy studies. Completion of the minor will give the student a broad understanding of the technical, economic, social, and political aspects of energy issues. For more information call the center at 619-594-6240 or 619-594-6155. The center works closely with local and state agencies concerned with energy policy and planning, and serves as a community resource in matters concerning local energy issues, and the impact of energy use of the environment. The Web site is <http://www-rohan.sdsu.edu/dept/physics/CES.html>.

### **Field Station Programs**

**Matthew Rahn, Interim Executive Director**

The Field Station Programs provide opportunities for a broad community of students and faculty to explore the natural ecosystems of southern California. In addition, the field stations serve SDSU by functioning as a liaison to broader public community, highlighting SDSU's expertise regionally, nationally, and internationally. The Field Station Programs manage almost 9,000 acres of San Diego and Riverside county land for university teaching and research.

SDSU currently has four field stations: the Sky Oaks Field Station, 1,640 acres of high elevation redshank chaparral habitat in the Chihuahu Valley east of Temecula Valley; the Santa Margarita Ecological Reserve (SMER), a 4,464 acre reserve located along the upper Santa Margarita River inland from Camp Pendleton in San Diego and Riverside Counties; Fortuna Mountain, 231 acres close to the SDSU campus located within Mission Trails Regional Park; and the Tijuana River National Estuarine Research Reserve, a 2,513-acre reserve which serves as an auxiliary field station for SDSU.

Providing research and education opportunities for the future requires detailed knowledge of how changes in the environment outside the boundaries of a certain area affect ecosystem dynamics within

that area. As habitat continues to be lost to development, areas such as the SDSU field stations will increase in importance as sites for studying natural ecosystems.

The proximity of sensitive habitats to a rapidly urbanizing landscape makes this region a recognized biodiversity "hot spot." San Diego State University has an extremely dynamic group of scientists (faculty, researchers, and students) working to understand these unique and threatened ecosystems. Research ranges from the global scale examining global warming and the impacts of increased carbon dioxide on native vegetation to the meso- and micro-scales of chaparral ecosystems dynamics, as well as plant, vertebrate, insect, and fungal diversity. Researchers at SDSU are also increasingly using sophisticated computer modeling and molecular techniques for analyzing environmental change. Natural sciences are the core users of the SDSU field stations. Biology, geography, geological sciences, hydrogeology, and other field sciences are consistent areas of study. There are growing opportunities for interdisciplinary work as well as for nontraditional study in the fields ranging from public health, civil and environmental engineering, recreation, business, and art, to education.

Persons interested in conducting research, instructional use, or access to the SDSU field stations should contact the academic programs of the SDSU Field Station Programs at 619-594-0580. Inquiries can also be made through the SDSU Field Station Web site at <http://fs.sdsu.edu/kf/>.

### Heart Institute

**Christopher C. Glembotski, Director**

The Heart Institute is sponsored by the College of Sciences and the College of Health and Human Services. The goals of the institute are to enhance basic and clinical research in the cardiovascular sciences, to foster undergraduate and graduate education in cardiovascular physiology and medicine, and to provide a community outreach service focused at heightening the awareness of cardiovascular disease and its prevention in the San Diego region surrounding SDSU. The institute is comprised of faculty members representing four different colleges at SDSU, as well as physicians and scientists from local hospitals and clinical research centers. Importantly, the institute also sponsors SDSU undergraduate and graduate student memberships, which strengthens the involvement of students in all aspects of Heart Institute activities. The unusual blend of talent and expertise that comprise the institute membership results in an interdisciplinary approach to cardiovascular research, education and community outreach that is unique to the Heart Institute. The institute sponsors special seminars, on- and off campus, which cover a wide range of topics in the field, and provides funding for the support of graduate students who are involved in cardiovascular research at SDSU. Areas of focus for the institute include studies of the molecular basis of cardiovascular disease, establishment of unique approaches for the early detection and prevention of cardiovascular disease, and the promotion of cardiovascular health in San Diego area K-12 schools. An important feature of these efforts that distinguishes the Heart Institute is the central role that SDSU students play in each of these areas. Funding for Heart Institute activities comes from a variety of sources, including the National Institutes of Health, the American Heart Association, the Muscular Dystrophy Association, the Rees-Stealy Research Foundation, and several San Diego-based biotechnology companies. For more information contact the Heart Institute office at 619-594-5504. The Web site is <http://www.bio.sdsu.edu/heart/sdsuhome.htm>.

### Center for Information Technology and Infrastructure (CITI)

**Eric G. Frost and Robert Welty, Co-Directors**

The Center for Information Technology and Infrastructure (CITI) was established to promote the vision of transforming and empowering SDSU to take advantage of emerging tools in optical networking, wireless communication, and human-computer interactions through visualization. It nurtures new technologies, builds on existing efforts in environmental monitoring, student safety, transportation studies, law enforcement and first responder interaction, homeland security, collaborative education, Internet technologies, GIS systems, and other

high interest areas. Activities extend to many sectors of the community (government, business, academia, non-profit organizations, private citizens) and among different jurisdictions within the region.

CITI is a product of the efforts of the SDSU Visualization Center resulting from community exercise development and participation. Its infrastructure exists in the form of hardware, software, facilities, people, and relationships. Many of these resources were informally gathered through the efforts of the SDSU Viz Center, the SDSU Research Foundation, and relationships with corporations. SDSU has actively collaborated and established partnerships with other academic and medical institutions, law enforcement and military agencies, local, state and federal governmental agencies, and high technology corporations. It has a strong relationship with the University of California, San Diego (UCSD), and the California Institute for Telecommunications and Information Technology (Calit2). The center's continuing involvement in community exercises and organizations also results in a strong, collaborative relationship with regional law enforcement and first responder agencies. These efforts promote additional research, resulting in increased awareness and understanding, a higher state of preparedness, and greater safety for our residents across the region.

CITI pursues four major themes, which provide framework for the center and a pathway for diverse projects: homeland security; natural disaster mitigation and response; global sharing of information and collaborative visualizations; and remote sensing and environmental monitoring. The Web site is <http://citi.sdsu.edu/>.

### Center for Inland Waters

**Stuart H. Hurlbert, Director**

The Center for Inland Waters is an interdisciplinary academic unit consisting of faculty members from four SDSU colleges (Arts and Letters, Engineering, Health and Human Services, Sciences). Its purpose is to foster basic and applied collaborative research among SDSU scientists and scholars on inland water resources and ecosystems, the application of their expertise to the solution of water-related problems in southern California and adjoining regions, and the coordination and development of courses, curricula, and physical facilities for water-related instruction and research. Inland water resources include the water supply for domestic, agricultural and industrial uses, the growing system of aqueducts, reservoirs, and aquifers in which this supply is transported and stored, and the rivers, lakes, and wetlands important as habitat for wildlife, as maintainers of environmental health, and as recreation areas. Of special interest to the center are social, economic, hydrological, public health, and ecological issues concerning the Colorado River and its delta, the Salton Sea, and the new Tijuana and Santa Margarita Rivers and their watersheds. The center is operated as a special unit of the College of Sciences and is administered by a director and an elected executive committee. Information on the center and regional water resources is available at <http://www.sci.sdsu.edu/salton/>.

### Institute for International Security and Conflict Resolution (IISCOR)

**Dipak K. Gupta, Director**

The SDSU Institute for International Security and Conflict Resolution (IISCOR) encourages and facilitates teaching and research in the multidisciplinary area of international security and conflict resolution. Specifically, topics such as nuclear armaments, international and intranational conflict, sociopolitical violence, and global environmental issues as they relate to security are covered.

The institute is a joint effort of the College of Sciences, the College of Arts and Letters, and the College of Professional Studies and Fine Arts. IISCOR is administered by a director and advised by an executive committee consisting of faculty members representing the different disciplines that provide input into the study of international security and conflict resolution.

The institute promotes teaching and research by organizing public forums, faculty and student seminars, developing appropriate curricula for undergraduate and graduate instruction and facilitating research and scholarly activities. SDSU offers, through IISCOR, a multidisciplinary Bachelor of Arts degree in International Security and Conflict Resolution. The Web site is <http://www-rohan.sdsu.edu/~iiscor/index.htm>.

### Center for Research in Mathematics and Science Education (CRMSE)

**Kathleen M. Fisher, Director**

The Center for Research in Mathematics and Science Education (CRMSE) is an interdisciplinary consortium of faculty interested in research on substantive questions related to the learning and teaching of science and mathematics. The center currently has members from the faculties of biology, geological sciences, mathematics and statistics, physics, policy studies in language and cross-cultural education, psychology, and teacher education. CRMSE is administered by a director and an associate director, who are appointed by the deans of the Colleges of Sciences and Education, in consultation with CRMSE members. Through its activities, CRMSE initiates, encourages, and supports the scholarly pursuit of important theoretical and applied problems in mathematics and science education. CRMSE supports faculty in their current research projects and in the preparation of manuscripts for publication and grant proposals for continued research. The center administers the Doctoral Program in Mathematics and Science Education that is offered jointly by SDSU and the University of California, San Diego. It also houses the Professional Development Collaborative to serve area teachers. The main office of the center is located at 6475 Alvarado Road, Suite 206, San Diego, CA 92120-5013; telephone 619-594-5090; campus mail code 1862. The Web site is <http://www.sci.sdsu.edu/CRMSE/>.

### Center for Microbial Sciences

**Stanley R. Maloy, Director**  
**Anca M. Segall, Associate Director**

The Center for Microbial Sciences is a research center dedicated to the study of microorganisms. The center's mission is to provide a productive, stimulating, and interactive research environment that will lead to rapid progress in the fields of microbial biology. The center integrates multiple scientific approaches to elucidate basic biological principles that helps in combating human health problems caused by microorganisms and stimulates applications of microorganisms in the biotechnology industry.

The center encourages multidisciplinary scientific research by bringing together a group of creative, cooperative investigators with different scientific backgrounds to attack major questions in microbial biology using a variety of experimental approaches. The center also trains scientists to attack important but neglected problems in microbial biology. The close proximity of the Center for Microbial Sciences to a nucleus of biotechnology companies facilitates interactions with industry. The center also collaborates with neighboring institutions with expertise in other biological areas (UCSD, Scripps Research Institute, Salk Institute, Scripps Institution of Oceanography, and others) providing additional intellectual and physical resources.

The primary goals of the center are: *Research* – To attract a group of imaginative, interactive investigators and provide a stimulating environment for productive, innovative research in microbial biology; *Training* – To train a new generation of scientists to solve important problems in microbial biology using innovative experimental approaches; *Outreach* – to provide expertise and facilities for visiting scientists from academia and industry to learn new technologies. The Web site is <http://www.sci.sdsu.edu/~smaloy/CMS/>.

### Microchemical Core Facility (MCF)

**Forest L. Rohwer, Anca M. Segall, and Robert W. Zeller, Co-Directors**

The Microchemical Core Facility (MCF) is a component of the California State University Program for Education and Research in Biotechnology (CSUPERB). The MCF is a state-of-the-art facility that provides DNA sequencing and purification services for cell and molecular biologists associated with any of the 23 CSU campuses. In addition, the MCF provides for CSU faculty access to the most recent advances in computer-assisted analyses of molecular structure. Located on the third floor of the Chemical Sciences Laboratory building and managed by the Department of Biology, the MCF provides state-of-the-art molecular analyses and characterization to CSU scientists for the lowest possible cost, as well as fostering the training of university faculty at all levels in

the most recent techniques available in the molecular life sciences. Funding for the establishment and maintenance of the SDSU MCF is derived from the National Science Foundation with matching funds provided by the State of California. Call 619-594-1669 for more information. The Web site is [http://www.sci.sdsu.edu/dnacore/sdsu\\_dnacore.html](http://www.sci.sdsu.edu/dnacore/sdsu_dnacore.html).

### Molecular Biology Institute

**Greg L. Harris, Director**

The Molecular Biology Institute was established to serve interested departments of the biological and physical sciences in the coordination, support and enhancement of research and instruction in the molecular biological sciences. Interests and activities of the MBI encompass all approaches which aim to explain biology at the molecular level. The MBI sponsors a weekly seminar series that facilitates faculty and student interaction with scientists from other institutions. Currently, full members of the institute are drawn from the Departments of Biology, Chemistry and Biochemistry, and the Graduate School of Public Health, and participate in the respective Ph.D. programs. Associate members are drawn from a variety of disciplines that are cognate with the molecular biological sciences. The institute is also constituted as the university unit authorized to administer the master's degree program with an emphasis in molecular biology. The research programs of the MBI members are supported by a variety of agencies including the National Institutes of Health, the National Science Foundation, NASA, the American Heart Association, the American Diabetes Association, the Muscular Dystrophy Association, the Department of Energy, the US Department of Agriculture, and the California Metabolic Research Foundation. Additional information is available from the MBI office; 619-594-7429. The Web site is <http://www.bio.sdsu.edu/cmb/masters.html>.

### NExTWORK

**William A. Root, Director**

SDSU's Nexus for Technology Workforce Education (NExTWORK) functions as an incubator for new programs designed to help the university respond more nimbly to San Diego's technology workforce needs. Nextwork seeks to invent, implement, and promote new programs at the department and college levels that will help the university to identify, and to incorporate into our curricula promptly, those emerging technologies and technology skills that are critical to the regional workforce. Nextwork's goal is to insure that the number of SDSU technology graduates, and the skills they possess upon graduation, keep pace with local industry demand. Currently Nextwork focuses on the computer technology segment of the regional technology workforce; consequently the Department of Computer Science serves as the testbed academic department for Nextwork's prototype programs: The Technology Workforce Watch undertakes monthly surveys of the anticipated technology workforce requirements of a representative sample of local technology firms; The Technology Workforce Bulletin, mailed each semester to selected technology industry leaders and regional legislators, presents recent findings of the Technology Workforce Watch and describes SDSU's responding educational initiatives, if any; The Industry Certification Curriculum Program promotes expansion of existing computer science courses into multi-semester sequences including product-specific case-studies that provide excellent preparation for industry-standard certification exams; Nextwork's on-campus internships program provides a broad spectrum of relevant technology-oriented internships entirely within, and supporting, SDSU itself; Technology Training Partnerships with major commercial technology training providers offer SDSU students and faculty access to training in new technology areas in which SDSU has no current faculty presence.

Nextwork is administered by a director appointed by the dean of the College of Sciences, and resides in facilities provided by the College of Sciences. For further information, call the Nextwork office at 619-286-8715 or 619-994-8715.