

College of Sciences

Administration

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Catherine J. Atkins

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Executive Director of Development: Stacy Carota

Director of College of Sciences Advising: Emilio C. Ulloa

Director of Resource Management: Tony P. Carrasco

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) (Ph.D.), Chemistry (Ph.D.), Clinical Psychology (Ph.D.), Computational Science (Ph.D.), Ecology (Ph.D.), Evolutionary Biology (Ph.D.), Geophysics (Ph.D.), Mathematics and Science Education (Ph.D.).

Master's Degrees

Applied Mathematics (M.S.), Astronomy (M.S.), Bioinformatics and Medical Informatics (M.S.), Biology (M.A., M.S.), Chemistry (M.A., M.S.), Computational Science (M.S.), Computer Science (M.S.), Geological Sciences (M.S.), Homeland Security (M.S.), Mathematics (M.A.), Medical Physics (M.S.), Microbiology (M.S.), Physics (M.A., M.S.), Psychology (M.A., 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.A., 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, 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, Communication Systems, Geographic Information Science, Industrial/Organizational Psychology, Intellectual Property and Regulatory Affairs, Professional Computational Science, Regulatory Affairs, Residency Training in Radiation Therapy Physics, Single Subject Mathematics, Web and Mobile Applications Development.

Health Professions Curricula

Pre dental, Pre medical, Pre optometry, Pre pharmacy, Pre physician Assistant, Pre veterinary.

Research Centers and Institutes

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 as well as the study of other birth defects and disorders. 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.

Center for Energy Studies (CES)

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 greater San Diego 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 CES 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. The CES is closely integrated with the environmental sciences program, which offers a Bachelor of Science degree through the College of Sciences and the recently established SDSU Center for Regional Sustainability. The CES 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.

For more information, call the CES at 619-594-1354.

Center for Microbial Sciences

Anca M. Segall, Director

Stanley R. Maloy, 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.

College of Sciences

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.

Find out more about the center by visiting the website at <http://www.sci.sdsu.edu/~smalay/CMS/>.

Center for Regulatory Science

Catherine J. Atkins, Interim Director

Lisa C. Dowdy, Associate Director

The Center for Regulatory Science focuses on education and training related to the research, development, manufacture, commercialization, and post-marketing surveillance of pharmaceutical, biological, and medical device products regulated by the FDA and its international counterparts. The center's programs address the over-arching legal, ethical, and regulatory requirements for biomedical products. Programs provide students with the broad-based skills required by biotechnology companies as their initial product development projects progress from research and development into clinical research, process development, manufacturing, and beyond.

The Master of Science degree in regulatory affairs was the first program developed and offered by the center. Other offerings include an advanced certificate in regulatory affairs and an advanced certificate in intellectual property and regulatory affairs, offered in partnership with the University of San Diego School of Law.

Online e-learning technologies are used to make the center's education and training programs widely available to individuals outside of the San Diego region. Flexible learning options are designed to accommodate the busy work and travel schedules of industry professionals. The center is attuned to national and regional economic and workforce development issues, and interfaces with the California State University Program for Education and Research in Biotechnology (CSUPERB). Additional information is available from the Center for Regulatory Science office, 619-594-6030, <http://regsci.sdsu.edu>.

Center for Research in Mathematics and Science Education (CRMSE)

Randolph A. Philipp, Director

William C. Zahner, Associate 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 was established in the College of Sciences in 1986 and became an interdisciplinary center with the College of Education in 1987. The center currently has members from the faculties of biology, dual language and English learner education, mathematics and statistics, physics, 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 houses the Doctoral Program in Mathematics and Science Education (MSED) 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. For more information, contact 619-594-1579. The center may also be reached via campus Mail Code 1862 and at <http://crmse.sdsu.edu>.

Clinical and Cognitive Neuroscience Center

Karen D. Emmorey, Phillip J. Holcomb, Tracy E. Love-Geffen, Sarah Mattson, Ralph-Axel Müller, Lewis P. Shapiro, Executive Committee

The goal of the Center for Clinical and Cognitive Neuroscience is to create a framework for SDSU faculty and students to study brain-based language and cognitive processing and its disorders, enhance teaching and research mentoring in clinical and cognitive neuroscience, and to expand SDSU's capability to become a leader in an area that is rapidly developing and essential to understanding human behavior. Additional information is available at <https://slhs.sdsu.edu/ccn/>.

Coastal and Marine Institute (CMI)

Todd W. Anderson, Director

The Coastal and Marine Institute (CMI) promotes marine science research, education, and public service at SDSU. CMI emphasizes research in near-shore coastal ecosystems and is composed of faculty among departments within and outside the College of Sciences. The institute operates the SDSU Coastal and Marine Institute Laboratory (CMIL) located on San Diego Bay, facilitating faculty and student research and fostering interaction and collaboration with other institutions, agencies, and the community. CMIL offers closed-circuit and flow-through seawater, environmentally controlled rooms, a wet lab, analytical lab, equipment room, dive locker, and shop. A large yard for boat storage, equipment storage, and outdoor mesocosms to conduct research is also provided. The institute is administered by a director and an advisory council consisting of faculty members from participating departments, including Biology, Chemistry, Geological Sciences, and the School of Public Health. Additional information about marine studies is available from the Coastal and Marine Institute director, from the College of Sciences, and from the CMI website: <http://www.sci.sdsu.edu/CMI>.

Computational Science Research Center (CSRC)

José E. Castillo, Director

Andrew L. Cooksy, Paul J. Paolini, Satchi Venkataraman, 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 CSRC provides high performance computing and network support to the faculty in the College of Sciences, the College of Engineering, and other colleges on campus in need of computational infrastructure support.

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 contacting the CSRC at 619-594-3430 or <http://www.csrc.sdsu.edu>.

Edwin C. Allison Center for Earth System History

Stephen A. Schellenberg, Director

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 climate change and biodiversity, arguably the two most important topics facing current and future generations. Research materials of past and present faculty 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 and carbonate microsampling systems.

For more information, about the center, visit the website at <http://www.geology.sdsu.edu/facilities/allisonctr>.

Heart Institute

Christopher C. Glembotski, Director

The Heart Institute is sponsored by the College of Health and Human Services and the College of Sciences. 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 or at <http://www.bio.sdsu.edu/heart/sdsuhome.htm>.

Institute for Behavioral and Community Health (IBACH)

Guadalupe X. Ayala, Director

Administered through the School of Public Health, IBACH, formerly known as the Center for Behavioral Medicine, was established in 1982 for the purpose of promoting research and academic programs relevant to the application of behavioral science principles to medicine and health care. IBACH's current mission is to identify determinants of Latino and other health disparities and intervention approaches that address these determinants. IBACH has 27 investigators from the College of Health and Human Services (School of Public Health, Exercise and Nutritional Sciences), College of Sciences (Psychology), and the Fowler College of Business (Marketing). It has two centers, the South Bay Latino

Research Center and the Center for Research on Sexuality and Sexual Health. Strong research and teaching partnerships have been established with the UCSD School of Medicine, the Department of Pediatrics – Division of Child Development and Community Health, the Department of Family and Preventive Medicine, and Moores Cancer Center. Additional collaborations include Clinicas de Salud del Pueblo, Inc., Healthy Eating and Active Communities, San Ysidro Health Center Scripps Institute, Scripps Whittier Diabetes Institute, Inc., and WalkSan Diego. Funding comes from the National Institutes of Health (NCI, NICHD, NIDDK, NHLBI, NINR), Centers for Disease Control and Prevention, Patient Centered Outcomes Research Initiative, Robert Wood Johnson Foundation, American Cancer Society, Dentaquest Foundation, Howell Foundation, and Kaiser Family Foundation. The institute provides important research experiences to trainees at all levels who intend to pursue related careers and offers opportunities for project staff and graduate students to participate in community-based work. IBACH offices are located at 9245 Sky Park Court, Suite 221, San Diego, CA 92113; additional sites are in Imperial County (Calexico and El Centro) and Chula Vista. For more information about IBACH, please visit our website at <http://ibachsd.org>.

Institute for Ecological Monitoring and Management (IEMM)

The Institute for Ecological Monitoring and Management (IEMM) provides a productive, interdisciplinary, and collaborative environment for research directed at developing new approaches, techniques and models for ecological monitoring and management. It engages in applied research that conducts science in service of policy and management, and works to translate science for policy makers and the larger community.

IEMM serves as a nexus to promote inter-department and inter-college research initiatives and facilitates the incorporation of academic and scientific expertise and involvement into relevant restoration, conservation and monitoring projects in the greater San Diego area. Its mission is to create an internationally and nationally recognized research entity. IEMM has three primary goals: research, training, and community service.

Integrated Regenerative Research Institute (IRRI)

Mark A. Sussman, Director

The Integrated Regenerative Research Institute (IRRI) promotes faculty participation and collaboration in research and teaching programs relating to regenerative research on both basic and translational levels in health and disease. The institute (1) fosters and encourages communication of ideas and information among its membership for mutual professional improvement; (2) attracts students to SDSU for participation in research and teaching programs dealing with regenerative research, and encourages them to adopt affiliation with Institute members and to develop an interdisciplinary understanding of their particular areas of interest in regenerative biology; (3) fosters active, collaborative research programs among Institute members; (4) seek ways to expand and improve graduate and undergraduate instructional programs relating to regenerative research.

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 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

College of Sciences

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 at 619-594-5655 or through the Master of Science degree website at <http://www.bio.sdsu.edu/cmb/masters.html>.

Visualization (Viz) Center

Eric G. Frost, Director

The SDSU Visualization (Viz) Center uses computer visualization and communications to bear on societal problems. The Viz Center is focused on processing and providing data sets to the world for humanitarian assistance disaster relief (HADR) events such as earthquakes, tsunamis, volcanoes, wildfires; as well as poverty, sustainable resources, and first responders in their daily efforts to serve the public. The focus is on being a connecting resource between the campus, community, and the world in bringing together solutions to problems that information technology, imaging, data fusion, visualization, and decision support can assist. The Viz Center develops and deploys tools for homeland security and works closely with many of the homeland security academic and research groups on campus, at the SDSU Research Foundation (SDSURF), and regionally. The Viz Center provides the physical laboratory function for a DHS multi-year, grant-funded project to the SDSURF Regional Technology Center for the assessment of homeland security technologies, governance structures, and data needs on a regional basis. This effort has led to establishment of a national presence as SDSU becomes a leader in addressing homeland security issues. The Viz Center also collaborates with other institutions in Africa, Australia, Canada, Central Asia, China, Indonesia, and Mexico. We interact with companies to help deploy and develop technologies, especially for response to "all hazards" events.

Watershed Science Institute (WSI)

Trent W. Biggs, Director

The Watershed Science Institute (WSI) promotes collaboration among SDSU researchers and communities involved in the management and regulation of land and water resources. The objective of WSI is to improve the integration of science, policy, and management of watersheds by aligning research questions with critical management needs. The regional focus is on Southern California, including San Diego County, Imperial Valley, and the US-Mexico Border region, all of which face critical challenges related to water resources and water quality, drinking water supply shortages, climate change, water quality deterioration, impaired surface water bodies, soil erosion, and coastal contamination. WSI has collaborators across the university, including faculty in biology, civil and environmental engineering, geography, mathematics and statistics, and public health, and is a university-wide institute housed in the Division of Research Affairs. Community collaborators include the City of San Diego Water Department, San Diego Coastkeeper, San Diego Regional Water Quality Control Board, San Diego River Conservancy, San Diego River Park Foundation, Southern California Coastal Water Research Project, and others. For more information, visit <http://watershed.sdsu.edu>.

Field Stations Program

Paul Ganster, Director

The Field Stations Program provides 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 Stations Program 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 Stations Program at 619-594-0580 or through the website at <http://fs.sdsu.edu>.