

# Research at UC San Diego

Organized Research Units (ORUs) are academic units the University of California has established to provide a supportive infrastructure for interdisciplinary research complementary to the academic goals of departments of instruction and research. The functions of ORUs are to facilitate research and research collaborations; disseminate research results through research conferences, meetings, and other activities; strengthen graduate and undergraduate education by providing students with training opportunities and access to facilities; seek extramural research funds; and carry out university and public service programs related to ORUs' research expertise. The senior staff of these units are faculty members in related academic departments. Institutes and centers currently in operation at UC San Diego are described below.

In addition, the university is formally and informally affiliated with various private research organizations such as the Institute of the Americas, the Salk Institute for Biological Studies, Howard Hughes Medical Institute, Ludwig Institute for Cancer Research, and the Burnham Institute.

## ORGANIZED RESEARCH UNITS

### MULTICAMPUS RESEARCH UNITS

**The Institute of Geophysics and Planetary Physics (IGPP)** was established in 1960 and named the Cecil H. and Ida M. Green IGPP in 1994. It is a multicampus research unit of the University of California, headquartered at UC Riverside, with branches at UCSD, UCI, UCLA, UCSC, as well as Los Alamos and Lawrence Livermore National Laboratories. The present facility includes the Roger and Ellen Revelle Laboratory and the Judith and Walter Munk Laboratory. Present research concentrates on the study of crustal dynamics by measurements of gravity, tilt, displacement, and strain in both continental and oceanic environments; of regional seismicity and linear and nonlinear earthquake and explosion source mechanisms; of the variability of the Earth's geomagnetic field and its generation by the geodynamo; of the spherical and aspherical structure of the Earth by measurements of free oscillations, surface waves, and travel times; of seafloor tectonics using marine geophysical methods; of linear and nonlinear theoretical and computational fluid dynamics; of the variable mesoscale structure of the oceans and global ocean warming by acoustic tomography; of the structure of the oceanic crust and lithosphere by seismic and electromagnetic measurements on the ocean bottom and at the ocean's surface through seismic multichannel methods; of sea-floor and planetary topography and gravity using satellite methods; of nonlinear dynamics applied to geomorphology; and of tides, waves, turbulence, and circulation in the

oceans; of surface change caused by tectonic activity, or climate change using satellite Interferometric Synthetic Aperture Radar (InSAR), as well as airborne and spaceborne laser altimetry. The institute operates a global network of some forty broadband seismometers, the IDA (International Deployment of Accelerometers) Array, with ten of these stations in the former Soviet Union, which are telemetered by satellite to the institute; a crustal strain and seismic observatory at the Cecil and Ida Green Piñon Flat Observatory near Palm Springs; a scientific wireless network in California with SDSC, the High Performance Wireless Research and Education Network (HPWREN); a southern California network of Global Positioning System (GPS) satellite geodetic sites operated by the Scripps Orbit and Permanent Array Center (SOPAC) and the California Spatial Reference Center (CSRC); an acoustic network in the Pacific for measuring ocean temperature variability; a modern 3D data visualization facility; a 5m, X-band satellite receiving antenna for satellite remote sensing; a national Ocean Bottom Seismograph Instrument Pool (OBSIP); and telemetered seismic arrays in Kirghizia, and two locations in California. The institute does not grant degrees, but makes its facilities available to graduate students from various departments who have chosen to write their dissertations on geophysical problems. Undergraduate students are involved in independent research projects and as laboratory assistants. Members of the institute staff now hold joint appointments with the Departments of the Scripps Institution of Oceanography and Mechanical and Aerospace Engineering. Support for visiting scholars and grant matching funds is provided through an endowment to the Cecil and Ida Green Foundation for the Earth Sciences.

**The University of California Institute on Global Conflict and Cooperation (IGCC)** is a multicampus research unit serving all ten UC campuses and the Lawrence Livermore and Los Alamos National Laboratories. IGCC is based at the School of International Relations and Pacific Studies at UC San Diego, whose faculty provides IGCC's leadership.

IGCC's mission to educate the next generation of international problem-solvers and peacemakers is carried out through teaching activities, research, and public service opportunities. Scholars and researchers from inside and outside the UC system, government officials, and students from the United States and abroad have participated in IGCC projects.

IGCC's initial research focused on averting nuclear proliferation through arms control and confidence-building measures between the superpowers. Since then, its research program has diversified to encompass several broad areas of inquiry: regional relations, international environmental policy, ethnic conflict, terrorism, and international trade and policy issues. The receipt of a prestigious NSF award in 2002 for a program to train the next generation of nuclear policy experts has led to a rekindling of interest in research on traditional security issues. In 2009, IGCC won two of the seven awards under the Minerva Research Initiative, a DoD-sponsored, university-based social science research program for projects focusing on China's drive to become a world-class defense and dual-use technological and industrial power and on developing an integrated theory of

counterterrorism by collecting and testing new data on political violence and religious radicals.

IGCC supports UC research and teaching through its dissertation fellowships and seed money for cutting-edge projects. IGCC's development office provides an additional resource for UC faculty seeking foundation funding. IGCC also serves as a liaison between the academic and policy communities through its Washington, D.C., office, located in the UC Washington Center. The Washington office hosts the IGCC Foreign Policy Fellow and helps to arrange meetings and events for visiting UC researchers. The Washington office also sponsors the Washington Forum, a series of policy seminars and briefings to showcase UC faculty research results and to provide opportunities for interaction between professors and policymakers.

IGCC receives support from the regents of the University of California and the UC Office of the President (Office of Research). Extramural funding has been provided by the National Science Foundation, the U.S. Department of Energy, the U.S. Department of State, the U.S. Department of Defense, the U.S. Institute of Peace, the U.S. Department of Homeland Security, the Defense Threat Reduction Agency, the U.S. Domestic Nuclear Detection Office, the U.S. Centers for Disease Control and Prevention, the Japan-U.S. Friendship Commission, Japan's National Institute for Research Advancement (NIRA), the Canadian Centre for Foreign Policy Development, and the California Office of Homeland Security.

Important corporate and foundation support has come from the Carnegie Corporation of New York, the Ford Foundation, the MacArthur Foundation, the Ploughshares Fund, the Ocean Foundation, the McCormick Tribune Foundation, the East Asia Foundation, the Earhart Foundation, the Smith Richardson Foundation, the Embassy of Japan, and the Lockheed Martin Corporation.

IGCC publishes a monthly e-mail newsletter highlighting funding opportunities, a quarterly general newsletter, and occasional papers. For more information, visit the IGCC Web site at <http://igcc.ucsd.edu>. IGCC publications can be downloaded from the California Digital Library E-Scholarship Repository at <http://escholarship.org/uc/igcc>.

**The White Mountain Research Station (WMRS)** was established as a UC multicampus research unit in 1950 to support high-altitude research. The station includes four laboratory facilities located over a 3,000m (10,000 vertical ft.) altitude transect, ranging from the floor of the Owens Valley to White Mountain at over 14,000 feet above sea level. Located on the western edge of the Great Basin, WMRS also provides access to three major biogeographic regions (Sierra Nevada and White/Inyo montane, Mojave desert, and Great Basin desert), and geologically rich and diverse field sites. WMRS has evolved into a major multidisciplinary research and teaching institution in eastern California, and hosts programs in archaeology and anthropology, atmospheric and space sciences, biological and medical sciences, ecology, conservation and natural resource management, geological, hydrological, and earth sciences.

WMRS facilities include: (1) Owens Valley Laboratories with classrooms, offices, dormitories,

and food services for up to seventy people outside the Sierra resort town of Bishop, (2) a newly renovated lodge, cabins, classrooms, and laboratories for fifty people in the Bristlecone pine forest at Crooked Creek (3,094m altitude) (3) the Nello Pace Laboratory and Mount Barcroft facilities (3,801m altitude), which can house thirty-five people, and (4) the 450-square-foot Summit Laboratory on White Mountain peak (4,342m altitude), making it the highest research lab in North America.

All of the laboratories are linked by a high-speed wireless internet connection providing instant access between campus-based laboratories and remote-sensing projects in the field. The Owens Valley Laboratory includes a modern molecular biology and genetics laboratory used to study adaptations to the environment and management of the majestic—but endangered—Bighorn sheep. A geographic information system (GIS) laboratory that houses the USGS-funded “Eastern Sierra Geospatial Data Clearinghouse” is used by scientists and government agencies for natural resource research and policy decisions. WMRS also hosts a Center for Astrophysics and Cosmology at Barcroft and “The Deepest Valley Interagency Plant Propagation Center.”

WMRS hosts more than 3,000 users from over 100 institutions per year for research, teaching, and conferences. Research occurs year-round with access to the high-altitude labs at Barcroft via snowmobile. Summer is the busiest time at WMRS, with undergraduate internships, graduate students supported by WMRS Fellowships in residence, plus students and faculty from other universities around the world. Educational uses include several geology field courses and a NSF-funded Research Experience for Undergraduates program. WMRS sponsors professional and postgraduate training courses, annual professional society meetings, a community lecture series, an annual Open House at Barcroft in August, and offers published proceedings from symposia on the environmental science in the region. For more information, please see <http://www.wmrs.edu> or call the scheduling coordinator at (760) 873-4344 for reservations.

## GENERAL CAMPUS RESEARCH UNITS

The **BioCircuits Institute (BCI)** studies the dynamics and control of the biological networks that underlie the homeostatic regulation and signal responsiveness of cells and organisms. These circuits span the scales of biology, from intracellular submodules of interacting molecules and neurobiological intercellular networks to population dynamics and organ function. The collective dynamics of individual elements embedded in such circuits can provide the foundation for emergent behavioral functions. The potential utilization of these functions in practical devices calls for engineering solutions borrowed from nature, which in turn requires a detailed understanding of the underlying fundamental principles and mechanisms.

The BioCircuits Institute comprises four programs: neuroscience circuits, cell signaling circuits, gene regulatory circuits, and biomimetic circuits. The two cores of BCI are microfluidics/microscopy and computational modeling. Faculty from the biological sciences, chemistry and biochemistry, mathematics, mechanical and aerospace engineering, physics,

mathematics, electrical and computer engineering, bioengineering, and structural engineering divisions are actively involved in the institute’s activities and research. A distinctive and important aspect of BCI is the cross-fertilization of ideas arising from scientists and engineers who are addressing similar research problems in differing contexts.

The mission of BCI is the deduction and experimental validation of computational modeling approaches that can be used to understand, predict, and control complex biological behavior. Such an approach will be invaluable in the generation of logically consistent hypotheses and will provide a framework for the systematic comparison of data across multiple experiments. Experimentally validated models will lead to an understanding of how biology solves complex problems, and in this context, such approaches can be used to engineer biologically inspired control systems.

The **California Institute for Telecommunications and Information Technology (Calit2)** (<http://www.calit2.net>), an organized research unit, conducts research on the future of telecommunications and information technology and how these technologies will transform a range of applications important to the economy and citizens’ quality of life. These application areas include: environment and civil infrastructure, intelligent transportation, digitally enabled genomic medicine, new media arts, and disaster response.

Calit2, a partnership between UCSD and UCI, is one of four institutes established in December 2000 through the California Institutes for Science and Innovation (Cal ISI) initiative. It is funded by a state capital grant, federal research grants, industry, and foundations.

Calit2 unites faculty, students, and industrial and community partners into multidisciplinary teams with expertise drawn from two dozen academic departments at both campuses. These teams integrate individuals’ deep expertise to enable larger-scale studies than those typically led by single investigators.

Emerging technologies are prototyped in the context of Calit2 “living laboratories,” pushing traditional research one step beyond scholarly publication to building and testing integrated systems under real-world conditions on and beyond the two participating campuses. Research professionals at leading California telecommunications, computer, software, and applications companies are active partners in the more than fifty projects supported by Calit2.

The institute’s goal is to develop technology approaches that will benefit society and spur the state’s economic development, building on the explosive growth in bandwidth and connectivity provided by the wired and unwired Internet.

Two new facilities constructed at UCSD and UCI feature unique capabilities, shared resources, extreme bandwidth, and reconfigurable space.

The 215,000-square-foot facility at UCSD, completed in the summer of 2005, is home to a wide range of projects at the intersection of science, engineering, and the arts. The building is a physical manifestation of this multidisciplinary research agenda: It includes clean rooms for nanofabrication, digital theatres in a range of sizes and capabilities to

support new media arts and scientific visualization, test and measurement labs for circuit design, smart spaces for experiments in augmented reality, transmission and networking testbeds for wireless and optical communications experiments, and labs for designing systems on a chip. The building juxtaposes people and programs in uncommon proximity to maximize the potential benefit arising from experts in different disciplines working together.

A 120,000-square-foot building dedicated at UCI in November 2004 is equipped throughout with high-speed wireless Internet access, a Voice-over-IP phone system, and customized ad-hoc in-house networks. In addition, in a collaborative effort with the U.S. Geological Survey, the facility employs more than forty seismic sensors to measure ground and building motion with the same system. The facility also boasts a 3,700-square-foot clean room, a large-scale visualization laboratory, and labs for network research, optical devices, nanotechnology measurement, and media arts.

Calit2 has developed research and education partnerships with academic and industrial leaders in telecommunications and information technology across the nation and around the world, including Europe, North and South America, the Pacific Rim, and Southeast Asia. Calit2 is helping prepare students for the global workplace of the twenty-first century by supporting summer internships with researchers in Australia, Japan, Taiwan, China, and Thailand, and recently signed an e-learning collaborative agreement with India.

Calit2 has also established a global dedicated optical network with partners in the U.S., Netherlands, Japan, and Korea, which allows real-time collaboration between faculty and students in multiple research laboratories.

Through Calit2, students complement their course work by working on large-scale, multidisciplinary, team-oriented projects that conduct research, establish prototype technologies, and test those technologies in the field. The experience they gain makes them especially valuable to potential employers, including Calit2 industrial and community partners.

The **Center for Astrophysics and Space Sciences (CASS)** is an interdisciplinary research unit established in 1979. The center brings together academic and research staff from the Departments of Physics, Chemistry and Biochemistry, and Electrical and Computer Engineering. Research is conducted in the scientific areas of theoretical cosmology, computational astrophysics, observational cosmology, interstellar medium, and star formation; solar observational and theoretical studies; X-ray and gamma-ray astrophysics; experimental and theoretical magnetospheric and space plasma physics; and cosmochemistry, including the chemistry of interstellar matter.

CASS provides a jointly shared facility that has office, laboratory, and computer space to enhance the interchange of expertise. Researchers in CASS have access to many University of California observing facilities, including the two Keck 10m telescopes, Lick Observatories, and Keck Telescopes, and they have contributed experiments to many major NASA space missions, including the Hubble Space Telescope and the Rossi X-Ray Timing Explorer.

Associated with CASS are seventeen faculty, about twenty-five Ph.D.-level research staff, twelve graduate students, and thirty technical and administrative support personnel.

The center's facilities, faculty, and research staff are available to graduate students in the Departments of Physics, Electrical and Computer Engineering, and Chemistry and Biochemistry who have chosen to write their dissertation on subjects of research encompassed by CASS. Graduate and undergraduate courses in astrophysics, astronomy, and space sciences are developed and taught by the academic staff of CASS. The total yearly budget is about \$5 million, mostly from federal funding sources.

The founding members of the **Center for Chronobiology (CCB)** are twenty scientists from UCSD and the Salk Institute, representing eight different departments within four different UCSD schools. These departments represent the spectrum of disciplines that contribute to chronobiology research: bioengineering, biological sciences, pharmacology, philosophy, psychiatry, psychology, physics, and reproductive medicine. Research organisms span bacteria to humans, and approaches extend from computer modeling and engineering, biochemistry, genomics, and proteomics to animal behavior and clinical analyses of sleep.

The Mission of CCB is to

- Foster innovative research that reveals the mechanisms, general principles, and applications of biological rhythms in diverse organisms.
- Provide support for investigators to incorporate the study of daily rhythmicity into their biological studies, particularly as it relates to behavior, physiology, and medicine.
- Form alliances among scientists working in basic and clinical aspects of chronobiology.
- Train undergraduate, graduate, and postdoctoral students in cross-disciplinary approaches through chronobiology research.
- Produce and disseminate materials for education and scientific advocacy on chronobiology, a topic of intrinsic interest and broad societal relevance.

The **Center for Comparative Immigration Studies (CCIS)** is an interdisciplinary, multinational research and training program devoted to comparative work on international migration and refugee movements. Its primary missions are to conduct comparative (especially cross-national) and policy-oriented research; train academic researchers, students, and practitioners; and disseminate research conducted under its auspices to academics, policymakers, and NGOs through research seminars, conferences, publications, the Internet, and the mass media. CCIS seeks to illuminate the U.S. immigration experience through systematic comparison with other countries of immigration, particularly in Europe and the Asia-Pacific region.

The center promotes research in the following areas: (1) the causes, dynamics, and consequences (economic, political, and sociocultural) of international migration, including low-skilled and high-skilled migrant workers and refugees; (2) the determinants and outcomes of laws and policies to regulate immigration and refugee flows; (3)

transnational relationships (economic, political, cultural, ethnic) between immigrant sending and receiving countries; (4) the impact of international migration on citizenship, national identity, and ethnic relations; (5) immigrant rights, advocacy, and social services; (6) immigrant political mobilization and participation; and (7) the socioeconomic, political, and cultural interactions of immigrants with native-born residents of receiving countries.

CCIS hosts visiting predoctoral and postdoctoral research fellows, and conducts an annual field research project on Mexican migration to the United States. The center has an active publications program consisting of monographs, anthologies, and working papers. Funding is provided by the University of California, private foundations, and international agencies.

A number of graduate research assistantships are available. Applications for graduate study in any of the disciplines covered by CCIS should be directed to the academic department in which graduate study is to be undertaken.

The **Center for Energy Research (CER)** was established to help create solutions to the growing challenges of energy supply and utilization in our society. The center exists to facilitate, coordinate, and promote energy research and education. It accomplishes these goals by providing resources and administrative support to researchers, assistance with business development, event hosting, publicity, outreach, and educational activities. Approximately ninety-four faculty, staff, and students are affiliated with CER. The goals of CER are complementary to academic departments of instruction and research with an emphasis on bridging the various disciplines related to energy research on the campus. Emphasis is currently on combustion and fusion energy research. CER will also provide a vehicle for developing other dimensions of energy research, including energy policy research. The specific goals of CER are (1) to provide an interdepartmental coordinating function for energy research groups and projects at UCSD, (2) to enhance the prospects of extramural research funding involving interdepartmental and multidisciplinary collaborations in energy research, (3) to promote the visibility of energy topics in undergraduate and graduate programs at UCSD, (4) to provide a mechanism for interacting with other institutions involved in energy research with particular attention to potential industrial partners, and (5) to promote the visibility of energy research at UCSD to potential sponsors and funding agencies.

A number of graduate research assistantships are available. Applications for graduate study in any of the disciplines covered by CER should be directed to the academic department in which graduate study is to be undertaken.

The **Center for Human Development (CHD)** is an interdisciplinary, research-centered unit designed to meet the growing needs for interdisciplinary exchange on issues related to human development. The goal of CHD is to provide a forum to enhance dialogue among members from multiple disciplines, all of whom share common research interests in the developmental sciences but rarely have the opportunity to meet and exchange ideas. The center is organized around four integrated functional units (research, instruction, dissemination, assessment),

each designed to fulfill a specific set of needs and to make unique contributions to the larger enterprise. To achieve our goals, CHD unites faculty and researchers from various departments and research units. Our affiliated faculty and researchers are involved in a wide array of developmental research projects and research-based training and outreach programs, many of which are collaborative, cross-disciplinary efforts. We also offer postdoctoral fellowships, opportunities for graduate students from our affiliated departments, and work in close collaboration with the undergraduate Human Development Program.

The **Center for Iberian and Latin American Studies (CILAS)** coordinates and promotes Latin American and Iberian research and service activities for faculty and students in all departments at the university, as well as outreach programs for the San Diego community. It sponsors multidisciplinary colloquia, conferences, projects and publications, collaborations, and exchanges with Latin American institutions, and library expansion. CILAS has launched several new initiatives in the areas of culture and violence, natural resources and indigenous peoples, globalization from below, and new forms of citizenship that are linked to several publication agreements over the next years. The center also hosts visiting professors from Latin America and visiting scholars from Spain and Latin America. The center awards grants and fellowships each year to promising graduate students.

The **Center for Molecular Agriculture (CMA)** promotes research and education in plant genetics and plant molecular biology with the goal of applying that research to the improvement of crops. Crop improvement can no longer rely exclusively on traditional plant breeding methods but requires the application of new technologies that include, but are not limited to, genetics and genomics, informatics, molecular gene isolation, and plant transformation. CMA brings together researchers from UCSD and the Salk Institute and is a resource for the entire San Diego community. It provides a focal point for interaction with the local and statewide agricultural biotechnology industry. The center wishes to play an active role in the debate about the safe cultivation and use of genetically modified crops.

The **Center for Magnetic Recording Research (CMRR)** (<http://cmrr.ucsd.edu>) is an organized research unit whose mission is to advance the science and technology that will serve as the foundation for the information-storage devices, systems, and applications of the future. This mission is achieved in partnership with private foundations, and industrial and government sponsors, through the combination of an ambitious research agenda that reflects a shared vision of the participating organizations, and a research-driven program of education and professional training for the future leaders in information-storage technology.

CMRR draws upon the wide range of intellectual interests and resources at UCSD, with participating faculty from departments in the Jacobs School of Engineering, the Division of Physical Sciences, and the Graduate School of International Relations and Pacific Studies, as well as researchers in the UCSD Materials Science and Engineering Program, the San Diego Supercomputer Center, and the California

Institute for Telecommunications and Information Technology (Calit2).

The center supports five endowed professorial chairs. Research programs address fundamental problems in nanoscale storage technology, including recording physics and micromagnetics, nano-patterned magnetic materials and structures, mechanical interfaces and tribology, servo control systems, signal-processing techniques, and error-control coding. The historical focus on magnetic recording on disks and tapes has been augmented by projects that explore other nonvolatile storage mechanisms, including those based upon novel nanostructures, optical holography, spintronic materials, and solid-state “flash” devices. System-level research topics include object-based storage paradigms, “intelligent” storage devices, and data security.

Graduate and undergraduate student researchers, postgraduate researchers, professional scientists, and visiting scholars representing international academic institutions and industrial laboratories contribute to a research and educational environment that is dynamic and varied.

As part of the center’s mission to educate future leaders in the vital information-storage industry, faculty members teach specialized classes at the undergraduate and graduate levels that train students in the theoretical methods and experimental techniques underlying advanced magnetic recording technology and other nonvolatile storage techniques. Real-world research opportunities are also available to students through academic-year and summer internships with selected sponsors. In addition, the center contributes to the continuing education of professionals in the storage industry through regular seminars, research reviews, and focused workshops.

CMRR also supports a world-class information center for information-storage technology that provides a range of services to sponsors, resident researchers, and students. These services include licensed database searching, patent searching, document retrieval, and expedited access to proprietary technical resources.

The **Center for Networked Systems (CNS)** was formally established as an organized research unit at UCSD in 2005. CNS is pursuing a portfolio of large and small multidisciplinary projects designed to develop key technologies and frameworks for networked systems. Each project attacks a critical technical problem or framework and all contribute to our technical capability to build robust, secure, manageable, and open networked systems. CNS combines its research talents and strengths in partnership with key industrial leaders—achieving the critical mass and relevant focus necessary to accelerate research progress and create key technologies, framework, and systems understanding for robust, secure networked systems and innovative new applications. CNS is focusing its initial efforts in four key research areas:

- **Robustness:** Understanding networked system properties that enable flexible connection (composition) and sharing of networks, grids, and networked system applications while ensuring predictable performance, reliability, quality, and efficiency.

- **System and Application Security:** Technologies and architectures that enable applications and networked systems to be secured or protected against unauthorized use, observation, or denial of service.
- **Manageability:** Technologies and architectures that reduce the effort required to understand, design, operate, use, and administer networked systems.
- **Application/End-User Quality:** Technologies and architectures that provide both capabilities and understanding of application performance and end-user quality of experience, particularly in large-scale and open systems.

The **Center for Research in Computing and the Arts (CRCA)** is an organized research unit of UCSD that facilitates the creation of vanguard culture via computer science research. Areas of current activity include next generation digital media, multicore computing, experimental computer games, future cinema, networked multimedia, software studies, cultural visualization, science and art collaborations, virtual reality and computer-spatialized audio. CRCA is also the home of the UCSD branch of the NSF-sponsored Center for Hybrid Multicore Productivity Research.

As the University of California’s oldest arts research center, CRCA pursues speculative cultural activities that draw upon humanistic analysis, engineering innovation, and the insights of artistic expression. Faculty members devise new modes of artistic practice through their liaisons with international cultural institutions, technology industries, and interdisciplinary collaborations. CRCA provides the framework for a broad range of approaches to artistic, scholarly, and technological development that is at the basis of our digitally transformed culture. We actively encourage the investigation of what constitutes the potent cultural acts of our time and the viable mechanisms that should be engaged to create them. More information about the center, its researchers, public events, and the process for engagement, can be found at <http://crca.ucsd.edu>.

The **Center for Research in Language (CRL)** emphasizes the combination of theoretical and experimental approaches to language study. The research is interdisciplinary and draws upon the fields of cognitive science, communication, communication disorders, computer science, human development, linguistics, neurosciences, psychology, and radiology.

The center’s facilities accommodate laboratory research projects by the faculty and graduate students; facilities include a number of high-performance work stations, a computer laboratory, extensive equipment for audio recording and analysis, and equipment for psycholinguistic experimentation.

Current research projects include studies of language and cognitive development in children; language impairment in children and adults; word and sentence processing in bilinguals; studies of American Sign Language; cross-linguistic studies of language structure; development of neurally inspired parallel processing models of speech perception; first-language acquisition; cross-linguistic comparisons of language acquisition and aphasia; research on the integration of grammatical

analyses and theories; a project to collect large-scale text corpora in electronic form; and a study of expectancy generation in sentence processing. The center administers an NIH pre- and postdoctoral training grant, “Language, Communication and the Brain.” CRL has also entered into several institutional agreements with research institutions in Europe, Asia, and the Americas, providing for the exchange of personnel and support for projects of mutual interest. An ongoing workshop series presents a broad range of experimental approaches to the study of language. The center publishes a monthly electronic newsletter.

The Project in Cognitive and Neural Development is an activity of CRL. Its purpose is to provide a forum for interdisciplinary research on brain and cognition in human children, including research on the neural bases of language and communication. The studies focus on typically developing children and on children with language impairments, Down syndrome, or autism spectrum disorders. The researchers use a wide range of behavioral and neuroimaging methods to yield new information about the interaction between experience and brain development. The results of these studies have important implications for education and clinical practice. The project brings together faculty and research staff from the UCSD Departments of Cognitive Science, Human Development, Neurosciences, Psychology, and Radiology; the San Diego State University Departments of Psychology and the School of Speech and Hearing Sciences; and the Salk Institute for Biological Studies.

The **Institute of Engineering in Medicine (IEM)** (<http://iem.ucsd.edu/>) was established in July 2008 at UCSD to bring together outstanding faculty in the Jacobs School of Engineering (JSOE), School of Medicine (SOM), and Skaggs School of Pharmacy and Pharmaceutical Sciences (SSPPS), as well as other units, for interdisciplinary research and education at the interface of engineering and medicine for the improvement of health care. IEM consists of a network of faculty, students, staff, and partners both within and outside of the University of California. Currently the institute has more than 100 participating faculty members and twenty industry members.

The mission of IEM is to synergize the unique strengths at UCSD for the integration of engineering principles and novel technologies with biomedical and translational research, with the ultimate goal of improving health care delivery and enhancing the health and quality of life of humankind.

Research in the Institute of Engineering in Medicine focuses on the convergence of science, technology, and disease by applying an engineering approach to medicine. The four initial disease focus areas are cancer, cardiovascular diseases, metabolic disorders, and neurodegenerative diseases. The technology areas include imaging, genotyping/phenotyping, bioinformatics/system biology, medical devices/instrumentation, nanotechnology/nanomedicine, and stem cells.

The Institute of Engineering in Medicine works with academic departments to help develop interdepartmental, interdisciplinary educational programs that involve many departments on the general campus, as well as industrial partners. The goal is to encourage undergraduates, graduates,

as well as postdoctoral scientists, to work in areas at the interface of engineering and medicine, thus training the leaders of the next generation to drive and implement the applications of engineering and technology to health care.

The science conducted in IEM is organized into specific fields of research defined by the convergence of our broad areas of focus. Each center of research involves expert university faculty working together with industry and physicians to solve important health care problems through technological advancements. The Whitaker Center for Biomedical Engineering (WCBE) is the first such center. WCBE enhances industry-academia collaboration and interaction by fostering fruitful exchanges among WCBE members, the UCSD community, and various industry collaborators. WCBE has an Industrial Advisory Board to guide and further this cooperation. The board works closely with WCBE to enhance research collaboration, foster scientific exchange, facilitate funding opportunity, organize seminars and workshops, and facilitate student internship training and professional development. More information about WCBE is available at (<http://wcbe.ucsd.edu/>).

The **Institute for International, Comparative, and Area Studies (IICAS)** was created in 2001 to promote research on international, comparative, and cross-regional topics. Building on the substantial strengths of UCSD in international studies, IICAS coordinates and supports the research of faculty in departments, area studies programs, and the Graduate School of International Relations and Pacific Studies. It is closely associated with undergraduate and graduate education in international studies, including Eleanor Roosevelt College and the international studies major, whose program offices are housed within the institute.

IICAS has two principal roles. First, it serves as a research catalyst, fostering and incubating interdisciplinary and cross-area research groups and projects. Activities have included a faculty research project on states at risk, a multiyear, interdisciplinary research workshop examining the empire-to-nation transition, and an annual lecture series on Law and Society (co-sponsored with California Western School of Law). Second, IICAS coordinates and provides services for international and area studies programs in events planning and coordination. In this role, IICAS has co-sponsored campuswide panels and seminars that address critical international issues. It also encourages new programs in international and area studies, such as the European Studies initiative.

The **Institute for Neural Computation (INC)**. The institute's research projects are directed at understanding the modes of functioning of nervous systems through direct observation, experimental investigation, and modeling of neural structures; uncovering cognitive principles through psychological experimentation and parallel distributed-processing models; applying neural computation to the solution of major technological and scientific problems; and ultimately building a new generation of massively parallel computers based on the principles of neural computation.

The central premise of INC is that these diverse research efforts cannot be adequately achieved independently; instead significant progress will

come through the joint efforts of researchers in the relevant disciplines, including neuroscience, philosophy, psychology, cognitive science, physics, mathematics, economics, electrical and computer engineering, computer science and engineering, radiology, and linguistics.

Faculty from the UCSD Departments of Biology, Computer Science and Engineering, Cognitive Science, Economics, Philosophy, Neurosciences, and Radiology, and the Salk Institute for Biological Studies are actively involved in the institute's activities. The institute has a training program in cognitive neuroscience, an active visitors program and an industrial affiliates program with ongoing joint research projects. The institute sponsors a seminar series, the annual Rockwood Memorial Lecture, and several scientific workshops and conferences annually.

The goal of the Swartz Center for Computational Neuroscience, an off-campus lab of INC, is to observe and model how functional activities in multiple brain areas interact dynamically to support human awareness, interaction, and creativity. Research in the center involves development of computational methods and software, experimental methods and equipment; collection and analysis of human cognitive experiments; and collaborations to analyze data collected by other groups in such experiments.

The Machine Perception Laboratory, another activity of INC, seeks to gain insights into how the brain works by developing embodied systems that solve problems similar to those encountered by the brain. The lab focuses on systems that perceive and interact with humans in real time using natural communication channels (e.g., visual, auditory, and tactile information). To this effect lab personnel are developing perceptual primitives to detect and track human faces and to recognize facial expressions. Developing such systems requires a multidisciplinary approach that combines mathematical modeling, machine learning techniques, computational modeling of brain function, and behavioral experiments. Applications include personal robots, automatic tutoring systems, and automatic assessment of affective disorders.

Other projects include research on human movement disorders, automatic speech recognition, autism, social cognition, how sensory information is represented in the cerebral cortex, how memory representations are formed and consolidated during sleep, and how visuomotor transformations are adaptively organized.

**Institute for Pure and Applied Physical Sciences (IPAPS)** is an interdisciplinary research unit that brings together faculty and researchers in physics, chemistry, engineering, and Scripps Institution of Oceanography. The institute is concerned with fluids and materials. Specific subjects of research include superconductivity, ferromagnetism, semiconductor heterostructures, solid surfaces, plasma physics, hydromagnetics, turbulence, fluid mechanics, laser physics, and numerical analysis.

Within IPAPS is the Center for Interface and Materials Science (CIMS), which emphasizes interdisciplinary collaborative research on the properties of surfaces, thin-layered composites, and novel materials, as well as their technological applications. With centralized space and equipment,

CIMS brings together faculty and research staff from the Departments of Physics, Applied Mechanics and Engineering Sciences, Chemistry and Biochemistry, Electrical and Computer Engineering, and the Scripps Institution of Oceanography.

The **Kavli Institute for Brain and Mind (KIBM)** is a virtual environment unhampered by disciplinary boundaries, providing scientists with opportunities for effective interdisciplinary integration of research and knowledge. KIBM will transcend traditional disciplinary barriers to foster new discourse among scientists, accelerating discoveries about the connections between mechanism and behavior.

KIBM's mission is to support research that furthers our understanding of the origins, evolution, and mechanisms of human cognition, from the brain's physical and biochemical machinery to the experiences and behaviors called the mind. KIBM leverages UCSD's preeminence in such fields as neuroscience, biology, cognitive science, psychology, and medicine, along with the extensive resources of the broader La Jolla scientific community, to extend its position as the pacesetter in brain-mind research and education, and as a vibrant hub for dissemination of its discoveries to advance science and benefit humankind.

To achieve its mission, KIBM provides funding for innovative research to focus on ideas that bridge different levels of organization of brain and mind, and for distinguished scientists to visit San Diego to broaden our interdisciplinary research on brain-mind issues.

Faculty from UCSD's Departments of Neurobiology, Cognitive Science, Neuropharmacology, Neuroscience, Philosophy, Psychiatry, Psychology, and Radiology; and scientists from the Salk Institute for Biological Studies, the Neurosciences Institute, and The Scripps Research Institute participate in KIBM research, lectures, and workshops.

The **San Diego Supercomputer Center (SDSC)** has enabled science and engineering discoveries through advances in computational science and high-performance computing for the past two decades. Data is an overriding theme in SDSC activities. By developing and providing data cyberinfrastructure, the center acts as a strategic resource to science, industry, and academia, offering leadership in the areas of data management, grid computing, bioinformatics, geoinformatics, and high-performance computing. The mission of SDSC is to extend the reach of the scientific community by providing data-oriented technology resources above and beyond the limits of what is available in the local laboratory, department, and university environment. SDSC is an organized research unit of UCSD with a staff of scientists, software developers, and support personnel, primarily funded by the National Science Foundation (NSF). Two key SDSC projects include the Geoscience Network (GEON) and the Science Environment for Ecological Knowledge (SEEK). GEON weaves together separate informational strands into a unified fabric that enables the discovery of data relationships within and across Earth science disciplines.

SEEK uses SDSC's computational science resources to provide the computational and data-management components of UCSD's strong

environmental informatics program. Reflecting the dramatic increase in humankind's ability to change the environment, the study of environmental informatics is increasingly critical to California. SDSC and UCSD are building and supporting a program that spans scales from the molecular level to entire populations, accurately modeling the impact of population on the environment.

In addition, SDSC pursues data management activities such as digital library initiatives, data-system standardization, and opportunities to impact large-scale data mining, analysis, and knowledge synthesis with academic, federal, and commercial partners. SDSC's high-end computing unit is leading a national effort to understand and deploy the most capable computational environments and to make those environments easily accessible and usable by scientific communities—locally, nationally, and globally. SDSC maintains leadership in critical strategic capabilities, including chemistry, parallel applications and performance modeling, scientific visualization, and increasing collaborations with the social sciences.

Researchers involved in SDSC's integrative biosciences area are developing projects to understand how cellular behavior emerges from the molecular level, how tissue behavior emerges from the cellular level, and so on up to the level of the organism. SDSC is collaborating in this area with the UC San Diego School of Medicine, the Center for Research in Biological Structure, The Scripps Research Institute, the Salk Institute for Biological Studies, and local biotech and pharmaceutical companies. SDSC also is focusing on large-scale collaborative bioscience projects worldwide using an infrastructure based on high-performance computation and analysis of massive amounts of data.

Major academic researchers around the country use the powerful computing resources at SDSC to make breakthroughs in diverse areas of science—from astronomy and biology to chemistry and particle physics.

SDSC's state-of-the-art computational resources and support include DataStar, a 15.7 teraflops (trillion floating point operations per second) supercomputer with a total shared memory of seven terabytes. DataStar is among the top supercomputers in the world and is used by researchers in academia and industry to conduct large-scale, data-intensive scientific research applications that involve extremely large data sets or have stressful input/output requirements.

SDSC collaborates with eight partners—including the National Center for Supercomputing Applications at the University of Illinois, Argonne National Laboratory, the Center for Advanced Computing Research at the California Institute of Technology, and the Pittsburgh Supercomputing Center—in the TeraGrid project. This multiyear effort builds and maintains the world's most powerful and comprehensive distributed computational infrastructure for open scientific research. The TeraGrid integrates more than 110 teraflops of computing power through a cross-country network backbone that operates at forty gigabits per second. The storage facilities at SDSC alone include more than one petabyte of high-speed disk and six petabytes of

archival storage capacity, one of the world's largest academic storage installations.

SDSC hosts huge digital collections, including visualizations of earthquake simulations, disaster-recovery records, astronomical images from the 2-Micron All Sky Survey, images from the Art Museum Image Consortium, Chinese text from the Pacific Rim Digital Library Alliance, and tomographic images of the human brain. The data technology is also being used to prototype persistent digital archives for the National Archives and Records Administration and other government agencies with huge data archives.

The Cooperative Association for Internet Data Analysis (CAIDA) at SDSC engages Internet providers, vendors, and users in engineering and technical collaborations to promote a more robust, scalable Internet infrastructure. CAIDA works with the community to develop and transfer tools and technologies that provide engineering and other insights relating to the operation and evolution of the Internet infrastructure. CAIDA works with providers and researchers to refine Internet traffic metrics, foster shared research environments, and encourage the development and testing of advanced networking technologies.

SDSC's Applied Network Research group is currently conducting two Internet research projects. The first involves the National Laboratory for Applied Network Research (NLANR), an NSF-supported collaboration to provide technical, engineering, and traffic analysis support for NSF's High-Performance Connections sites and the nation's high-performance network infrastructure.

The second activity of the Applied Network Research group is the High-Performance Wireless Research and Education Network (HPWREN), a collaboration with Scripps Institution of Oceanography that created a noncommercial, prototype, high-performance, wide-area wireless network in San Diego County.

## SCHOOL OF MEDICINE RESEARCH UNITS

The **AIDS Research Institute** (<http://ari.ucsd.edu>): In 1996, the AIDS Research Institute (ARI), an Organized Research Unit (ORU), was established by the regents of the University of California to coordinate the diverse HIV/AIDS research and clinical activities on the UCSD campus. The mission of the institute, housed within the School of Medicine at UCSD, is to become a regional resource for HIV/AIDS research and information in the San Diego area. UCSD faculty have made major advances in our understanding of how the virus works, how it causes disease, how to treat HIV infection and its complications, and the impact of HIV infection on nationwide health and health-care costs. UCSD programs in HIV/AIDS, including 243 faculty members from thirty-four departments, are internationally recognized for their contributions to science and patient care. UCSD is ranked among the top ten AIDS programs in the country.

ARI programs include

- The Center for AIDS Research (CFAR)
- The Adult AIDS Clinical Trials Group (ACTU)
- The Adult AIDS Clinical Trials Network Leadership Group

- The Pediatric AIDS Clinical Trials Group (PACTG)
- The California NeuroAIDS Tissue Network (CNTN)
- The Special Infectious Disease Clinic of the VA San Diego Healthcare System
- The Acute Infection and Early Disease Research Program (AIEDRP)
- The California Collaborative Treatment Group (CCTG)
- The HIV Neurobehavioral Research Center (HNRC)
- The Southern California Primary Infection Program
- The HIV Costs and Services Utilization Study (HCSUS)
- The VA Quality Enhancement Research Initiative for HIV (QUERI-HIV)
- The San Diego AIDS Education and Training Center (AETC)
- The Owen Clinic, which provides primary health-care services
- The Antiviral Research Center (AVRC), which conducts clinical trials
- The UCSD Mother, Child, and Adolescent Program

The institute sponsors seminars and workshops and offers developmental grants to new investigators in the area of human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) related research. Together with research and development, the ARI is fully committed to serve as a community resource for information and assistance regarding infection, treatment, and education in HIV/AIDS. We are here to serve as the regional resource for all aspects pertaining to HIV/AIDS and, as a leader in research and education, to treat the infected and prevent the spread of further disease.

The UCSD-Salk **Center for Academic Research and Training in Anthropogeny (CARTA)** is based on ongoing efforts dating back more than ten years, and coordinated in the past by the UCSD Project for Explaining the Origin of Humans. The center was established to address some of the oldest questions in the world: "Where did we humans come from, and how did we get here?" To help answer these questions from a scientific perspective, a multidisciplinary group of researchers at UC San Diego, along with colleagues at the Salk Institute for Biological Studies in La Jolla, have founded a center to formally explore the origins of humanity (which is the definition of anthropogeny) and the many facets of what makes us human.

Definitive answers regarding human origins are most likely to come from discussions and studies that bring together a wide variety of approaches in the biological, biomedical, and social sciences, as well as aspects of the arts and humanities, with important input from the physical, chemical, and computing sciences. CARTA is transdisciplinary, meaning that it transcends or goes beyond traditional disciplines and builds bridges between them. In doing so, we are more likely to succeed, by working beyond the confines of individual disciplines and looking at knowledge about human origins as a broad-based continuum. The goals of

CARTA are essentially scholarly (academic) and range from understanding more about human and primate genetics and evolution to advancing knowledge in areas such as language, communication and cognition, and human society and culture.

Activities of CARTA include the organization of regular international symposia, developing an online Museum of Comparative Anthropogeny; organizing ethical access to resources for great ape research; development of a Library of Anthropogeny, stewardship of electronic databases, serum and skeletal collections donated by the Primate Foundation of Arizona; facilitating a graduate elective course and specialization track on human origins at UCSD, the teaching of evolutionary principles at the School of Medicine; and development of a peer-reviewed journal. Support for IT infrastructure and informatics is being provided by the San Diego Supercomputer Center and Calit2. The CARTA Web site is at <http://carta.anthropogeny.org>.

The **Center for Research in Biological Systems (CRBS)** is an organized research unit that exists to provide human resources, high-technology equipment, and administrative services to researchers engaged in fundamental research on cell structure and function relationships, particularly those involved in central nervous system processes, cardiovascular networking, and muscular contraction. CRBS scientists investigate these processes through invention, refinement, and deployment of sophisticated technologies, especially

- High-powered electron microscopes that reveal three-dimensional cell structures
- State-of-the-art X-ray crystallography and magnetic resonance analysis that provide detail on protein structures at high resolution
- Laser-scanning and Confocal light microscopes that reveal molecules tagged with fluorescent markers as they traffic within cells and pass transfer signals within and between cells
- High-performance computing and grid-based integration of distributed data

CRBS facilitates an interdisciplinary infrastructure in which people from biology, medicine, chemistry and biochemistry, and physics can work with those from computer science and information technologies in collaborative research. CRBS researchers share interests in the study of complex biological systems at many scales, from the structures of enzymes, proteins, and the body's chemical communications network at atomic and molecular levels to an organism's physiology, strength, and support at cellular and tissue levels.

CRBS infrastructure integrates resources for high-performance computing, visualization and database technologies, and the grid-integration of large amounts of archival storage data. The California Institute for Telecommunications and Information Technology (Calit2) and the San Diego Supercomputer Center (SDSC) are collaborators in simulating the activity of biological systems, analyzing the results, and organizing the growing storehouse of biological information.

The aims of CRBS researchers are met in interdisciplinary research activities of major federally funded efforts that are presently the heart of CRBS:

- BIRN, the Biomedical Informatics Research Network (<http://www.nbirn.net>), tests new modes of large-scale biomedical science. BIRN builds infrastructure and technologies to enable large-scale biomedical data mining and refinement.
- NCMIR, the National Center for Microscopy Imaging Research (<http://ncmir.ucsd.edu>), specializes in the development of technologies for improving the understanding of biological structure and function relationships spanning the dimensional range from 5nm<sup>3</sup> to 50µm<sup>3</sup>.
- NBCR, the National Biomedical Computation Resource (<http://nbcrc.ucsd.edu>), conducts, catalyzes, and advances biomedical research by harnessing, developing, and deploying forefront computational, information, and grid technologies.
- JCSG, the Joint Center for Structural Genomics (<http://www.jcsg.org>), creates new technologies to drive high-throughput structure determination. The Bioinformatics Core at UCSD is responsible for target selection, sample tracking, information management, structure validation and deposition, and poststructural analysis. Through these functions, the group provides the integrated informatics backbone required for the successful operation of JCSG.

CRBS researchers also have significant roles in collaborations with

- PRAGMA, Pacific Rim Applications and Grid Middleware Assembly, establishes sustained collaborations and advances the use of grid technologies in applications throughout the Pacific region to allow data, computing, and other resource sharing.
- Optiputer (<http://www.optiputer.net>) involves the design and development of an infrastructure to integrate computational, storage, and visualization resources over parallel optical networks using lambda switching communication mechanisms.

CRBS is an entity evolving as research evolves. It was established in 1996 to involve researchers from disciplines across UCSD, the School of Medicine, the Salk Institute for Biological Studies, Calit2, and SDSC, including bioengineering, biology, chemistry, computer science, mathematics, neurosciences, pharmacology, psychiatry, and physics, and forges interactions with biotechnology and biocomputing companies for technology transfer. Interaction, collaboration, and multiscale research produce new perspectives, reveal fruitful research topics, lead to the development of new technologies and drugs, and train a new generation of researchers in biological systems.

The mission of the **San Diego Clinical and Translational Research Institute (CTRI)** is to create an environment that advances health care through interactions between basic scientists, clinical investigators, community physicians, and patients. We intend to address the barriers that inhibit productivity and rapid translation of research progress into new therapies.

Biomedical discovery is progressing at an increasingly rapid pace. The translation of laboratory research into interventions that improve human health depends on our collective ability to take new knowledge, develop new treatments and technologies, and then prove these therapies to be safe and effective. These advances must then be translated into improved health care and outcomes. To complete the cycle, the questions and challenges presented by clinicians and the general public seeking even better solutions find their way back into the laboratory, driving fundamental research that leads to further discovery.

CTRI provides an environment where this continuous cycle leading from biomedical research to advances in patient care and back into the laboratory can flourish. Through CTRI we bring together a multidisciplinary network of basic scientists, clinical researchers, physicians and other health care providers, community leaders, patients, and volunteers. Their work is supported by advanced information technologies, powerful imaging tools, and core facilities, such as DNA sequencing and biomarker analysis, to ensure that the path from laboratory to clinical application is speedy, efficient, and cost-effective.

In addition to scientific support, we provide the opportunity for all of our partners to share ideas and collaborate in the process of innovation benefiting patients and society.

CTRI is here to serve our partners and to offer opportunities to participate with us in understanding, preventing, and treating human disease. Please look through our Web site for ways to access our services and to learn more about translational research: <http://CTRI.ucsd.edu>.

**CTRI serves as the coordinating center for a multidisciplinary program encompassing**

- Four health sciences professional schools spanning two universities: School of Medicine (UCSD), Pharmacy and Pharmaceutical Sciences (UCSD), Nursing (SDSU), and Public Health (SDSU)
  - The Rady School of Management (UCSD)
  - Ph.D. degree programs in bioinformatics, clinical psychology, public health (including epidemiology, health behavior, and global health), audiology and hearing sciences, pharmaceutical sciences, biostatistics, and language and communicative disorders. Many of these are dual programs with SDSU, which is a minority-serving institution due to its substantial Latino student population.
  - Masters of science degree program in clinical research (the UCSD K30 program)
  - The Jacobs School of Engineering, including the new Institute of Engineering in Medicine and the von Liebig Center for Entrepreneurism and Technology Advancement
  - Numerous institutes and centers that support translational research
- CTRI has additional institutional partners, including**
- Our academic medical center and university (UCSD) with three hospitals (UCSD Medical Center, Rady Children's Hospital, and the VA San

Diego Healthcare System)

- Four biomedical research institutes (Salk Institute for Biological Studies, Burnham Institute for Medical Research, J. Craig Venter Institute, and La Jolla Institute for Allergy and Immunology)
- A community health group (Palomar Pomerado Health) with two hospitals (total of 435 beds) and an enthusiastic group of community physicians in the East County of San Diego
- Three interdisciplinary computing resources (SDSC, Calit2, and Division of Biomedical Informatics)
- A close partnership with the local biotechnology community and their associations. One of these, CONNECT, was founded by UCSD to foster entrepreneurship in the San Diego region by accelerating the growth of businesses in the life sciences. The other key industry organization is BIOCOM, an association representing more than 550 biotechnology companies in Southern California.

Together with biomedical doctoral training programs within our institution (neurosciences, biomedical sciences, molecular pathology, and bioengineering), the Physician Scientist Training Program, and the translational CTRL education programs, we are training the next generation of clinical and translational scientists.

The **Glycobiology Research and Training Center (GRTC)** seeks to facilitate and enhance glycobiology research and training throughout California. Current faculty membership includes many UCSD faculty from several departments across the School of Medicine, Scripps Institution of Oceanography, and the general campus as well as adjunct faculty at nearby institutions. Affiliate members include interested scientists in the La Jolla area as well as faculty from several other UC campuses and California institutions of higher learning.

Glycobiology is the study of the structure, biosynthesis, and biology of sugar chains (called oligosaccharides or glycans) that are widely distributed in nature. All cells and many proteins in nature carry a dense and complex array of covalently attached glycans. These are often found on cellular and secreted macromolecules, in an optimal position to modulate or mediate events in cell-cell and cell-matrix interactions that are crucial to the development and function of complex multicellular organisms. They can also mediate interactions between organisms (e.g., between host and parasite). Simple rapidly turning-over protein-bound glycans are also abundant in the nucleus and cytoplasm, where they appear to serve as regulatory switches. The development of a variety of new technologies for exploring the structures of these glycans has recently opened up this new frontier of molecular biology.

GRTC (<http://grtc.ucsd.edu>) seeks to foster interactive research in glycobiology by coordinating the availability of state-of-the-art instrumentation and expertise in the structural analysis of glycans through a Glycotechnology Core Resource (<http://glycotech.ucsd.edu>), increasing intellectual and collaborative interactions by organizing symposia and joint programs and seminars, coordinating joint applications for extramural support, improving

access to relevant informatics, and facilitating the transfer of basic glycobiology research to practical applications. The center also strongly emphasizes graduate, postgraduate, and medical student education in glycobiology, including contributions by the faculty to core curricula, as well as to elective courses and journal clubs.

The UCSD **Institute for Genomic Medicine (IGM)**, founded by the UCSD School of Medicine and the UCSD Skaggs School of Pharmacy and Pharmaceutical Sciences, is a center of excellence for organizing the multidisciplinary resources necessary to effectively translate the discoveries of genetic and genomic research from “bench to bedside.” IGM aims to link clinical and genomic information to facilitate personalized health care. By combining UCSD’s expertise in genetics, disease biology, and clinical practice with its strengths in computer science, bioinformatics, and systems biology, IGM is uniquely positioned to support all activities along the continuum of genomic medicine. IGM aims to discover new pathways in human health and disease and to translate these discoveries to clinical and preventive medicine. Our multidisciplinary physician-scientist teams integrate clinical phenotypes with genomic, transcriptomic, proteomic, metabolomic and signaling approaches to understand and treat genetic contributions to human disease. For information about IGM, please contact Peggy Bonine at (858) 246-0949 or [mbonine@ucsd.edu](mailto:mbonine@ucsd.edu).

The **Rebecca and John Moores UCSD Cancer Center (CC)**, active in the fight against cancer since 1979, is a National Cancer Institute-designated Comprehensive Cancer Center. The specific goals of the Cancer Center are to enhance the present level of basic research, increase collaborative research, increase the application of basic science to solve clinical problems through translational research, disseminate new knowledge to oncology professionals and scientists in the San Diego community, enable the biomedical industry to transfer new technology to the clinical setting, develop a strong effort in cancer prevention and control, and educate and train undergraduate and postgraduate physicians, and basic scientists. Under the auspices of a Cancer Center Support Grant from the National Cancer Institute, there are seven active program areas within the Cancer Center. These include Cancer Biology, Cancer Genetics, Cancer Prevention and Control, Cancer Pharmacology, Cancer Symptom Control, Translational Oncology, and Viral Malignancy. Shared resources at the Cancer Center include biostatistics, clinical trials, data compilation and analysis, digital imaging, DNA sequencing, flow cytometry, histology and immunohistochemistry, microarray, molecular pathology, nutrition, radiation medicine, and transgenic mouse.

Research and educational grants support the training of postdoctoral fellows and medical students. The Clinical Trials Office coordinates clinical research trials involving cancer patients at UCSD and is the focal point for a large Oncology Outreach Network, which provides state-of-the-art protocol treatment opportunities for patients in a broad geographic area. Patient care activities of the Cancer Center are located in the Combined Oncology Clinic at the Theodore Gildred Facility and in UCSD Medical Center, both located in Hillcrest, and at the Oncology

Clinic of the Perlman Ambulatory Care Center and in UCSD Thornton Hospital, both located in La Jolla. Basic research activities of the Cancer Center are carried out at a variety of other locations on or adjacent to the La Jolla campus. Total membership of the Cancer Center exceeds 260 laboratory investigators and clinical physicians from twenty-two academic departments. The research funding for Cancer Center members exceeds \$180 million.

The **Sam and Rose Stein Institute for Research on Aging (SIRA)** is an ORU committed to the development of the latest advances in biomedical and behavioral science knowledge and their application to issues of successful (healthy) aging and the prevention and reduction of the burden of disability and disease in late life. Established in 1983 as the first ORU on aging within the University of California system, the unit consists of more than 120 faculty members with outstanding track records in research and who encompass a wide range of expertise. These faculty members represent multiple departments within the UC San Diego School of Medicine, ranging from bioengineering and family and preventive medicine to neurosciences and psychiatry. Over the past two decades, SIRA has made major contributions to research, research training, and dissemination of information to the San Diego, national, and international community in geriatrics and gerontology. It has funded more than seventy-five pilot grants for junior faculty during critical stages of their careers and funded more than 100 undergraduate and medical students interested in aging research. In 2005, SIRA was awarded a grant from the National Institute on Aging (NIA) to conduct summer research training of medical students from around the country, with a focus on healthy aging. In this program, students are paired with experienced scientists from UCSD and provided an opportunity to do hands-on research by pursuing basic science, clinical, or health services projects. In addition, SIRA has also recently targeted its pilot grant awards to junior faculty pursuing research projects pertaining to successful aging. Along with its Web site (<http://sira.ucsd.edu>), SIRA publishes a monthly newsletter, *Successful Aging*, which is distributed to more than 2,000 individuals and organizations. The monthly SIRA Public Lecture Series has resulted in more than 250 public lectures provided by SIRA faculty on topics of interest to the general public, with the lectures also broadcast on UCSD-TV. SIRA Grand Rounds and Geriatric Journal Club further enhance the multiple venues provided to educate professionals and the general public on age-related topics. Under the leadership of Dilip Jeste, M.D., director of SIRA since 2003, SIRA has launched comprehensive, longitudinal, bio-psycho-social studies of successful (or healthy) aging. Scientists at SIRA believe that studying health and well-being and how and why people age without significant mental, physical, or social impairment should be at least as important as studying why people become ill. In the coming years, SIRA will strive to become a national and international resource on successful aging and impact people’s ability to age well. For more information, contact us at (858) 534-6299 or [steininstitute@ucsd.edu](mailto:steininstitute@ucsd.edu) or visit our Web site at <http://sira.ucsd.edu>.

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## PROJECTS

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The goal of the **African and African-American Studies Research Project (AAASRP)** is to facilitate faculty, postgraduate, and graduate research in the areas of Africa and African diaspora studies in the social sciences and the humanities, and to foster the comparative, cross-national, and interdisciplinary dimensions of research, with a core group of scholars drawn from several fields in the social sciences and humanities. These research efforts are linked directly to larger local and international community concerns.

The project sponsors visiting scholars, focused research groups, a seminar, and symposia. Faculty from seven university departments are involved. The project oversees the African Studies Minor. The project is also part of the UC Systemwide Consortium of African Studies Programs and the national Association of African Studies Programs. It provides the basis for the establishment of an organized research unit on African and African-American Studies at a later time. For more information, contact the AAASRP office at (858) 822-0265.

The **Project for Explaining the Origin of Humans** is a broad-based multidisciplinary coalition of investigators in the La Jolla area (from UCSD as well as institutions from the surrounding area and around the world) who are interested in defining and explaining the evolutionary origins of humans and in generating testable hypotheses and new agendas for research regarding this matter. Areas of current interest include primate genetics and evolution, paleoanthropology and hominid origins, mammalian and primate neurosciences, primate biology and medicine, the roles of nature and nurture in language and cognition, human and primate society and culture, comparative primate reproductive biology, geographic, environmental and climatic factors in hominid evolution, as well as general theories for explaining humans. The group includes UCSD faculty from the Departments of Anthropology, Biology, Chemistry and Biochemistry, Cognitive Science, Linguistics, Medicine, Neurosciences, Scripps Institution of Oceanography, Pathology, and Psychology.

The **Project for Econometric Analysis (PEA)** is concerned with the analysis of economic and financial data and with techniques for modeling relationships between economic variables and testing economic theories. As economic variables have properties not generally found in other fields, standard procedures from mainstream statistics are often not appropriate. The field of econometrics has been developed to deal with these issues. Its importance is indicated by its effect on the methodologies in other social sciences, such as political science and empirical history, and the fact that several Nobel Prize winners in economics have been econometricians. In fact, the 2003 Nobel Prize in economics was awarded to Clive Granger and Robert Engle, two of the founders of PEA.

The Project for Econometric Analysis supports the work of an active group of researchers and provides opportunities for productive interaction among faculty and students. Areas of active research include financial econometrics, nonlinear time series modeling, properties of neural network models, the

theory of economic forecasting and various actual applications including evaluations of models and forecasts in finance and economics. PEA allows links with workers from other universities in this and other countries. In 2000–01 and 2001–02 the project had visitors from Europe, Asia, North America, and Australia; some were senior and some were pre- and postdoctoral students. Faculty members and graduate students associated with the project presented their research at workshops and conferences worldwide. In addition, PEA facilitates the submission of grant proposals to outside agencies.

The **Project in Geometry and Physics (PGP)**, established in 1987, provides opportunities for increased collaboration between mathematicians and physicists. The project hosts several scientific meetings each year and also sponsors a number of research seminars with distinguished scientists from inside and outside the UCSD community.

The **Project on International Affairs (PIA)** is one of the international programs within the Institute on International, Comparative, and Area Studies, focusing on economic and political interactions between states. The project serves to promote interdisciplinary research on international politics and international economics; disseminate current research to UCSD faculty and students; provide a multidisciplinary focal point for research and programming; and enhance campus and community understanding of international political and economic affairs.

The **Project on Responsible Conduct of Research Education (RCR Education Project)** was created in 2003 to promote RCR education both at UCSD and nationally. To achieve this goal, the RCR Education Project facilitated the formation of the Responsible Conduct of Research Education Committee (RCREC), a special interest focus for the Association for Practical and Professional Ethics. RCREC provides leadership to the research community in promoting education in the responsible conduct of research.

The RCR Education Project and RCREC are intended to be a broad-based coalition, representing medical, social, and behavioral research, and public and private institutions. Through these collaborations, the RCR Education Project will lay the foundations for RCREC to advance programs of RCR education, develop RCR education standards, certify or identify programs that meet those standards, facilitate the exchange of RCR education programs among research institutions, and develop outcome measures to evaluate the success of the endeavor. Specific objectives of RCREC are to: 1) promote RCR education as a central responsibility for any institution involved in research; 2) develop clear definitions for RCR education, including goals, standards, competencies, and methods for evaluating the effectiveness of programs; 3) assist institutions, RCR programs, and investigators in identifying and developing RCR education curricula and resources; 4) facilitate discussion and collaboration among federal agencies, public and private research institutions and organizations, professional societies, and businesses in developing, coordinating, and sharing new and existing RCR educational programs within the research community; and (5) identify and

overcome barriers to fulfilling RCR educational needs and requirements.

The Public Policy Research Project was established to facilitate interdisciplinary research and educational opportunities in public policy and business-government interaction. Through conferences, focused research groups, and lecture series, the project acts as a catalyst for interaction among economists, political scientists, moral philosophers, historians, cognitive scientists, anthropologists, and sociologists. The project supports programs that: (1) help faculty obtain funding that are engaged in policy-related research, (2) conduct research apprenticeships for doctoral students working on research projects dealing with issues and processes of public policy, and (3) provide technical support and arrange faculty-proposed conferences within the scope of the project's mission statement.

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## NATURAL RESERVE SYSTEM (NRS)

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The **Natural Reserve System (NRS)** was founded to establish and maintain significant examples of California's diverse ecosystems and terrain. These reserves are used for teaching and research in all disciplines, from geology and environmental sciences to anthropology and art. Faculty and students of the University of California and other institutions are encouraged to use any of the thirty-four reserves in the system for serious academic pursuits. The San Diego campus administers the following four reserves:

**Dawson Los Monos Canyon Reserve:** This 218-acre reserve is located in the cities of Carlsbad and Vista in north coastal San Diego County. Its young, stream-cut valley contains a year-round creek with precipitous north- and south-facing slopes. The major habitat types are Southern Riparian Woodland, Diegan Coastal Sage Scrub, Perennial Coastal Stream, Coast Live Oak Woodland, Mixed Grassland of native bunchgrass and introduced annuals, and South Coastal Mixed Chaparral. This area is also of unique and significant historical and archaeological value. A small field station provides opportunities for small laboratory classes, overnight stays, and on-site research.

**Elliott Chaparral Reserve:** Located ten miles to the east of campus, this 107-acre reserve, adjacent to the large expanse of Marine Corps Air Station Miramar that is undeveloped, features Chamise Chaparral typical of the Southern California coastal plain and a large stand of mature planted eucalyptus. It is readily available during a normal three-hour lab period or for term paper-length field studies as well as for more lengthy projects.

**Kendall-Frost Mission Bay Marsh Reserve:** This sixteen-acre reserve, together with the city of San Diego's contiguous Northern Wildlife Preserve, constitute the last remaining forty acres of tidal salt marsh on Mission Bay and one of the few such wetlands remaining in Southern California. It is recognized for the habitat it provides for several rare and endangered birds including the light-footed clapper rail, Belding's savannah sparrow, and the California least tern, as well as many resident and migratory shorebirds and waterfowl, and several fish

species. An on-site trailer houses limited residential and laboratory facilities, and extensive facilities exist within ten miles on the UCSD main campus and at the Scripps Institution of Oceanography. There are opportunities for studying restoration ecology of upland and tidal habitats.

**Scripps Coastal Reserve:** This reserve consists of disjunct shoreline and cliff-top (or "knoll") portions. The shoreline part consists of the 67-acre San Diego Marine Life Refuge extending seaward 1,000 feet from the high tide line, and surrounding the Scripps Institution of Oceanography (SIO) Pier. Habitats include sandy beach and submerged plain, to 60 feet below mean lower low water, seasonally exposed cobble beach, rocky reef, pier pilings, and upper submarine canyon ledges. Habitats of the clifftop knoll and canyons include coastal sage scrub, maritime succulent scrub, southern coastal mixed chaparral, and disturbed grassland. The latter is particularly suitable for ecological restoration experiments. This reserve is enhanced by the availability of the laboratories and facilities of adjacent SIO and the main UC San Diego campus.

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