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UC DAVIS SCHOOL OF MEDICINE
HISTORY OF THE
RESEARCH PROGRAM

FITZ-ROY CURRY

TED WANDZILAK

LARS BERGLUND



UC Davis School of Medicine History of the Research Program

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Introduction



C. John Tupper, founding dean of the UC Davis School of Medicine



Temporary buildings on the UC Davis campus – the first home for the School of Medicine



The Sacramento County Hospital in 1972

The School of Medicine at University of California, Davis, was established in 1966 with the first class of 48 students matriculating in 1968. Under its founding dean, C. John Tupper, who was recruited from the University of Michigan, the School developed its goals and reputation as an educator of primary care physicians, a purpose and aspiration that has remained a central core of its educational mission throughout its over 50-year history. Initially, the school was housed in temporary buildings on the Davis campus. The first School of Medicine permanent building was completed on the Davis campus in 1976, closely coincident with the purchase of the Sacramento County Hospital, which housed clinical education. This solution was reached after plans to build a new hospital in Davis did not materialize.

While a divided campus with basic teaching in Davis and clinically focused education and training in Sacramento was a challenge until the relocation of all teaching activities to the Sacramento campus in 2008, the two locations also offered advantages. The campus at Davis is particularly renowned for its strengths in basic and applied biology and is the only campus of the University of California system with the combined presence of a College of Agricultural and Environmental Sciences, College of Biological Sciences, College of Engineering and Schools of Medicine and Veterinary Medicine. Growing out of the original county hospital and favored by a central Sacramento location with ample space for building, the University of California, Davis, Medical Center has grown into a regionally and nationally respected academic health system that also houses a significant portion of the School of Medicine research activities.



Standing with Chancellor Emil Mrak and Dean Tupper (front central) are from right to left Drs Hunter, Wolfman, Davis, Bolt, Beljan, Lindsay and Carlson

Governance and Administration of the School of Medicine

The initial years of the school under the leadership of Dean Tupper were focused on building a rigorous education curriculum, attracting faculty and establishing a clinical center to serve the educational role of the school. The first seven faculty members recruited, pictured above, were fondly called “The Lucky Seven.”

In response to the significant challenges related to health care reform during the 1990s and the fiercely competitive local environment dominated by managed care, major modifications to the School of Medicine and hospital governance and administrative structure were undertaken. Dr. Hibbard Williams, who had served as the second dean from 1980 when the founding dean, Dr. John Tupper, stepped down, left after twelve years of service, and was followed as dean by Dr. Gerald Lazarus for the period of March 1993 to June 1997.

This shift coincided with many significant changes in the school. Dean Lazarus partnered with Hospital Director Frank Loge, who had served in this capacity since 1984, to launch a fully integrated strategic planning effort to generate a single plan for the future of both the school and hospital. To ensure broad acceptance, well over 120 faculty, hospital administrators and staff contributed to this two-year strategic planning effort, which led to a set of recommendations (see below). In tandem with this process, the school’s 23 academic departments developed strategic plans that included quantitative data, an assessment of strengths and weaknesses, and short and long-range goals and objectives. Recommendations from this strategic planning process led to major changes in the overall governance and administration of the school and hospital.

The first seven faculty members recruited were fondly called “The Lucky Seven.”



Hibbard Williams (right) and Gerald Lazarus (left), second and third deans of the UC Davis School of Medicine, respectively.

Also resulting from this Strategic Plan were key changes in the structure of the clinical enterprise and in virtually all other components of the academic mission. Key changes in governance and administration were as follows:

A. Creation of the University of California, Davis, Health System

In the 1990's, the School of Medicine and the UC Davis Medical Center hospital and clinics were coordinated in governance and objectives by the creation of the UC Davis Health System (UCDHS).

Prior to 1995, the dean of the School of Medicine and the director of hospitals and clinics each reported separately to the provost and executive vice chancellor of UC Davis. Until that time, the operation of the School of Medicine and of the hospital and clinics were fully separate entities in virtually all areas. While the individual reporting lines for the dean and the hospital director remained, governance of the medical school and medical center were dramatically restructured by the creation of the UCDHS. This change resulted in an integrated governance of the medical school and medical center, with unified missions of education, research, patient care, and public service. The dean would serve as the executive director of the health system responsible for ensuring that the academic needs and missions of the school were addressed. The hospital director would serve as the health system's chief operating officer responsible for the overall management of the hospital and clinics and for maintaining a patient and fiscal base that met academic needs. The primary management of UCDHS resided with the Health System Management Advisory Committee (HSMAC) whose membership at the time included the dean, the hospital director, the executive associate dean of the School of Medicine, the associate director for Clinical Affairs, the chief operating officer of the hospital, the associate director of Financial Services, and the chair of the UCDHS Council of Chairs. Ensuring that the academic mission remained as the overriding goal of the institution, the committee consisted of four faculty and three hospital administrators.

The creation of an integrated health system enabled the school and the medical center to jointly establish and prioritize objectives in a collegial, cooperative and equitable manner. The transition of cultures from a separate medical center and school administration to a joint health system governance required that the School of Medicine administration and faculty and hospital administration would work together diligently to forge a common vision to move the process forward. With a mutual focus provided by oversight of UCDHS, the combined objectives of our institution to achieve excellence in education, biomedical research and patient care have been pursued over close to 30 years.



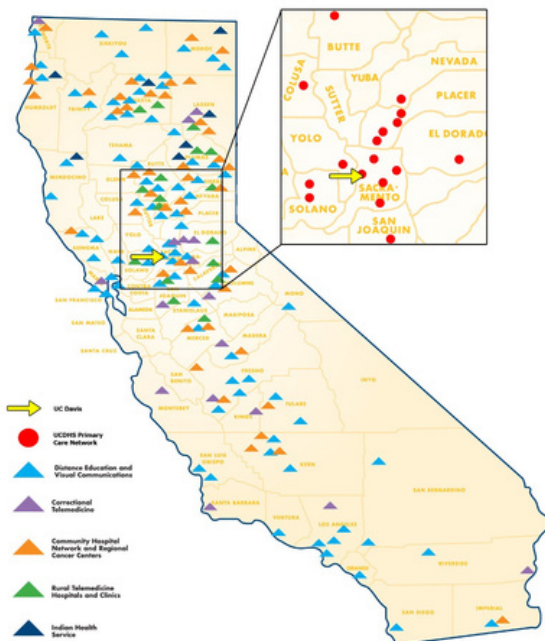
Shriner's Hospital, Sacramento, located on the UC Davis Medical Center

In parallel with the development described above, the clinical enterprise was restructured to match changing market needs, providing stability for hospital based clinical care. Notably, the addition of the 80 bed Shriners Hospital for Children in 1997 brought a new clinical enterprise to the medical center campus and strengthened research programs in pediatrics, orthopaedic surgery and burn treatment. As pointed out below, this partnership has over time resulted in research advances in these areas.

B. Creation of the Clinical Practice Board (CPB)

Preceding the creation of UCDHS, the Clinical Practice Board (CPB) was formed in 1991, initially in response to faculty concern about the level of participation in clinical program planning and management. The CPB was set up as the governing body of the University Faculty Medical Associates, the clinical practice organization of the clinical faculty. It was composed of one representative from each clinical department (either the chair, or a designee approved by the Dean). Its mission was to organize the clinical practice of the faculty and work in conjunction with the hospital to develop a high quality, cost effective and comprehensive system of patient care. Included in the duties of the CPB were to advise the dean and hospital director on behalf of the clinical faculty on policy matters regarding clinical practice affairs, to provide oversight and coordination of the clinical programs, to develop standardized medical practice procedures and to optimize the approaches to clinical care to best meet the needs of the UCD teaching and research programs. The activities of CPB were essential for the full transition into managed care as the overall strategic plan was developed and implemented. In the fall of 1997, the CPB was replaced by the UCDHS Council of Chairs, advisory on all matters that pertain to the clinical enterprise of the entire health system.

C. Creation of the Primary Care Network (PCN)



The reach of UC Davis throughout California including primary care locations and telemedicine sites (see section on the Center for Health and Technology below)

One of the institution's greatest challenges was to develop a clinical infrastructure to function effectively in a managed care environment. To maintain a patient base adequate in size to meet both academic and financial objectives, the strategic plan recommended that UCDHS establish a network of primary care physicians dispersed over a broad geographic region in Northern California that could serve as a referral base. Under the leadership of the associate director for Clinical Affairs, Dr. Allan Siefkin, and the medical director of the PCN, Dr. Phillip Raimondi, by 1997 the PCN encompassed a total of 130 community-based, university-salaried physicians in 36 locations representing 18 different communities in a five-county area and serving approximately 250,000 patients. It was envisioned that the PCN would make important contributions to the educational programs by allowing novel opportunities for the future training of students, residents and FNP/PAs.

Coupled to the stability of inpatient-based medicine has been a marked growth in ambulatory care. The PCN proved to be a key contributor to the clinical enterprise and brought a robust patient referral base. The number of outpatient visits increased from 218,000 in 1988-89, to 367,000 visits for 1996-97 and when combined with visits in the Primary Care Network (PCN), to over 660,000 visits. Together with several other local health care providers, the UCDHS established the Western Health Advantage (WHA), a partnership that lasted for many years.

D. Merger of functions between the school and the hospital

In summary, the creation of UCDHS allowed the merger of many of the component operations of the School of Medicine and the hospital and clinics. These included:

- Coordination of the clinical enterprise under the direction of the associate director for Clinical Affairs for UCDHS.
- Provision of financial management for the entire health system, both the school and medical center, through UCDHS Financial Services.
- Creation of a UCDHS Information Systems division to coordinate information systems at the enterprise level.
- Management of a conjoint development program by a Health Sciences Advancement entity.
- Management of all staff issues/recruitment for both hospital and school by a UCDHS Human Resources unit.
- Central coordination for graduate medical education activities through a UCDHS Graduate Medical Education Advisory Committee (GMEAC).
- Establishment of conjoint planning, marketing and public affairs activities for all medical school and medical center activities.
- Creation of the Educational Advisory Board to serve as advocate for all educational programs of the school and medical center.

In 1997, there was both reason for optimism and need for caution regarding the structure of the combined governance. The most significant benefit envisioned was that the new organizational structure defined common goals and coordinated all planning efforts and resources. Over time, this has resulted in a considerable flow of resources from the medical center to the medical school to provide active sustenance for the academic programs, including the establishment of key research centers. A secondary effect of this was the ability of UCDHS to differentiate itself in the regional market as the only academic medical center that could expeditiously leverage research innovations into practice.

This theme became more pronounced over time as research centers with this mission were initiated (e.g. CTSC, Cancer Center). The creation of UCDHS resulted in a foundation for productive interactions between all facets of the medical school and medical center, eliminating redundancy and enhancing efficient communications. A potential major concern at the time was that full coordination had yet to be achieved, and that the health system needed to be diligent to ensure this would happen. The importance of ensuring that individuality, a key part of the academic mission, would not be destroyed by a growing corporate structure and set the School of Medicine apart from the university at large was also recognized. Finally, it was recognized that maintaining the existing routes for faculty to provide continuous and active input into the direction of the enterprise was critically important. At this time, discussion was underway to merge the PCN with the regular faculty practice organization and create a single clinical enterprise: the UC Davis Medical Group (UCDMG).



UC Davis Medical Center

E. The Dean's Office



Joseph Silva, the fourth dean of the School of Medicine

Governance of the academic programs resided fully with the dean of the School of Medicine. Dr. Joseph Silva, originally recruited from the University of Michigan, who had served as the Chair of Internal Medicine and been one of the institution's key leaders since 1982, assumed the deanship in July 1997 when Dean Lazarus stepped down.

At that time there was considerable stability in the office as many of the associate deans and key senior staff had served for many years. Examples include Executive Associate Dean James Castles (associate dean since 1977 and appointed executive associate dean in 1985); the Associate Dean for Student Affairs Ernest Lewis, (appointed in 1982); and Associate Dean for Curricular Affairs Donal Walsh, (appointed in 1983). The associate dean for research, Dr. Roy Curry, and the associate dean for faculty development, Dr. Marge Steward, were appointed to these newly created positions in 1995.

Assistant deans at the time included Dr. Lindy Kumagai for minority affairs and Dr. Brian O'Neill for VA affairs, both appointed in 1991. Dr. Faith Fitzgerald was appointed as assistant dean for student affairs in 1996, supporting Dr. Lewis. When Dr. Castles stepped down in 1997, Dr. Thomas Anders took over the position as executive associate dean, and in this capacity proved instrumental in facilitating the foundation of the MIND Institute (see below).



Claire Pomeroy, the fifth dean of the School of Medicine

This organization lasted until 2005 when Dr. Claire Pomeroy, recruited from the University of Kentucky in 2002, to serve as executive associate dean after Dr. Thomas Anders, assumed the role as the fifth dean of the school. She requested that the role as dean be restructured to a formal vice chancellor and dean position, where the hospital director reported to the vice chancellor. Recognizing that the growth of the School of Medicine created a need for more specialization, she split the role of executive associate dean into two positions, one executive associate dean for clinical affairs (Dr. Thomas Nesbitt) and one executive associate dean for academic affairs, including both research and education (Dr. Ann Bonham). As Dr. Bonham left for a leadership position at AAMC in 2008, Dr. Frederick Meyers took over this role. Dr. Pomeroy took a very active interest in the research program and was a driving force in developing a key strategic plan (see below). During her time as Dean, the School of Medicine experienced an unprecedented growth of the research enterprise,

including NIH funding for a CTSA center and the creation of a Stem Cell research center (described below).

Dr. Pomeroy stepped down in 2013 and was followed in 2014 by the sixth dean, Dr. Julie Freischlag, recruited from Johns Hopkins University. During her time, the executive dean for academic affairs position was split into two vice dean positions, one for research (Dr. Lars Berglund) and one for education (Dr. Mark Servis), as Dr. Meyers was tasked to develop the institutional precision medicine program. At the time of Dr. Freischlag's departure in 2017, the Office of the President had initiated a reorganization of all University of California medical campuses separating the functions of dean and vice chancellor. As an interim role was required for both functions, Drs. Thomas Nesbitt and Lars Berglund were appointed as interim vice chancellor and dean, respectively. In 2018, following the appointment of Dr. Gary May as chancellor of UC Davis, Dr. David Lubarsky was recruited from the University of Miami as vice chancellor, followed by Dr. Allison Brashear, recruited from Wake Forest University as the seventh dean in 2019. When she left in 2021, Dr. Susan Murin was appointed interim dean.



From left to right, Julie Freischlag, sixth dean of the School of Medicine; Allison Brashear, seventh dean of the School of Medicine; and Susan Murin, current interim dean of the School of Medicine.

Since 2005, the administrative functions of the dean’s office have grown substantially, with a cadre of vice and associate deans responsible for the school roles in education, research, clinical care and outreach. In the research area, Dr. Roy Curry stepped down in 2008 and Dr. Lars Berglund, appointed initially as an assistant dean for clinical research in 2005, assumed a leadership role, initially as associate dean, later as senior associate dean and, attesting to the importance of the research area, as vice dean and associate vice chancellor, until his retirement in 2020. At that time, Dr. Kim Barrett was recruited from UC San Diego as vice dean for research, supported by associate deans Dr. Ted Wun (clinical and translational research), Dr. Angela Haczku (research infrastructure). Dr. Rachael Callcut joined in a new role (data science) in 2022. Dr. Melissa Bauman became associate dean for research infrastructure in October 2023, after Dr. Haczku stepped down from that role.

From left to right: Thomas Nesbitt, interim vice chancellor 2017-2018, Lars Berglund (right), interim dean 2017-2019, David Lubarsky, vice chancellor from 2018.



F. UCDMC Administration

The management team of UCDMC included Frank J. Loge (appointed director of hospital and clinics in 1984, prior to which he served as deputy director and associate director of hospital and clinics, and director of finance), and Robert Chason, chief operations officer since 1994 after having served as UC Davis Associate Vice Chancellor for Student Affairs from 1979. Dr. Allan Siefkin, a faculty member in the Pulmonary Division of Internal Medicine from 1979, was appointed associate dean/associate director for clinical affairs in 1994 and associate director for clinical affairs and executive director, UCD Medical Group. Dr. Gibbe Parsons, a faculty member since 1973 in the Department of Internal Medicine, was appointed UCDMC medical director in 1994. When Frank Loge stepped down in 1999, he was followed first by Marsha Marsh and then in 2002 by Robert Chason, who worked in close partnership with Dean Silva. Following the appointment of Dr. Pomeroy as vice chancellor, Robert Chason retired in 2008 and was succeeded as hospital director by Ann Madden Rice, recruited from the University of Iowa. Her attention was mainly focused on growth of the clinical enterprise



Top row, left to right: Frank Loge, Marsha Marsh, Robert Chason, Gibbe Parsons. Bottom row, left to right: Allan Siefkin, Ann Madden Rice, Brad Simmons.

and when she left in 2018, she was succeeded by the hospital’s chief operations officer at the time, Brad Simmons, originally from the University of Texas, who in turn left in 2023.

G. The Academic Senate

The Academic Senate has as its major responsibility the governance of the educational program for the M.D. degree as defined by the Standing Orders of the Regents of the University. The School of Medicine Academic Senate is administered by an executive committee (FEC) composed of two each elected representatives of faculty from the basic sciences, clinical sciences, and surgical sciences, and one representative each from the Department of Veterans Affairs/East Bay and non-academic Senate appointments. The dean of the school and the medical director serve as ex-officio members. The faculty have a substantive role in decision making within the school. Most permanent medical school committees fall under the umbrella of the Academic Senate, including Admissions, Educational Policy, Student Progress, Research Affairs, and Honors and Awards. In addition, the membership of the Compensation Advisory Committee contains elected faculty.

H. University administrative and campus collegial relationships



From left to right: Robert Grey, Larry Vanderhoef and Linda Katehi

Both the dean and the hospital director report directly to the provost and executive vice chancellor, who at the time of the creation of UCDHS was Dr. Robert Grey. The provost provides oversight of the administration

of UCDHS to ensure that the academic and clinical programs remain programmatically and fiscally viable, and that the clinical enterprise does not eclipse the viability of the academic programs. This process was initiated by Provost Vanderhoef, who preceded Provost Grey and who subsequently served as UC Davis Chancellor from 1994 until 2009, followed by Dr. Linda Katehi until 2016.

During Dr. Katehi's time as chancellor, a significant emphasis was placed on the growth of research and this coincided with a very close relationship between the UC Davis Office of Research and the SOM research leadership. Starting with Dr. Vanderhoef and followed by subsequent officeholders, the provost has continued to be very engaged in the SOM. Following Dr. Grey as provost was Dr. Virginia Hinshaw, a virologist and microbiologist from UW Madison, who was recruited in 2001. When she left in 2007, Dr. Enrique Lavernia, dean of the College of Engineering, was appointed in an interim position, followed in 2010 by Dr. Ralph Hexter, an expert in classics and comparative languages, previously dean of humanities at UC Berkeley and president of Hampshire College. As Dr. Katehi stepped down as chancellor in 2016, Dr. Hexter was appointed as interim chancellor until the recruitment of Dr. Gary May as the seventh UC Davis chancellor in 2018. During this time, Dr. Kenneth Burtis, previous dean of the College of Biological Sciences, served as interim provost. Dr. Hexter stepped down in 2020, and was followed by Dr. Mary Croughan, a public health epidemiologist recruited from the University of Nevada, Las Vegas.



From left to right: Virginia Hinshaw, Enrique Lavernia, Ralph Hexter and Gary May

Throughout this period, there has been increased recognition on the part of campus administration of the unique needs of the medical enterprise and a willingness on their part to facilitate a more entrepreneurial spirit. An excellent collegiality exists between the medical school and other campus faculty and the role of the School of Medicine in the research portfolio of UC Davis has grown substantially, with the SOM Office of Research playing an increasingly important role at the campus level, particularly with the UC Davis Office of Research. This was initiated during the time that Dr. Barry Klein served as vice chancellor for research and was particularly prominent from 2010 when Dr. Harris Lewin took the role as vice chancellor. It has continued through his successors, Drs. Cameron Carter and Prasant Mohapatra.



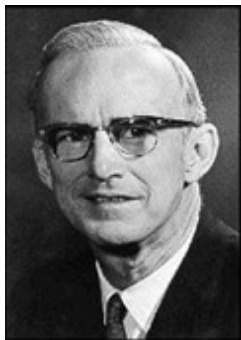
Four UC Davis vice chancellors for research: Barry Klein, Harris Lewin, Cameron Carter and Prasant Mohapatra



Tupper Hall

Research at the School of Medicine

A. Early research activities 1970's – 1990's.

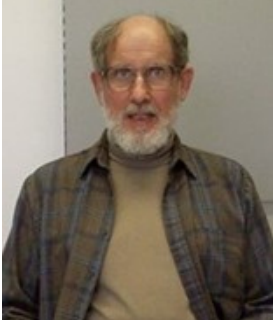


Loren Carlson

The Davis campus was the primary focus of research for both basic and clinical science researchers throughout the 1970's and into the late 1980's. Initially, all research activities were housed in temporary buildings, but following the completion of the four floor Medical Sciences 1A building in 1977 (renamed Tupper Hall in recognition of the founding dean, Dr. John Tupper), many basic science departments moved there from the temporary buildings. The departments of Biological Chemistry, Human Physiology, and Pharmacology occupied the fourth floor while the departments of Anatomy and Cell Biology, Medical Microbiology, and Pathology occupied part of the space on the third floor. The second floor of Tupper Hall housed teaching laboratories, curricular support and administration. The anatomy teaching laboratory was housed on the first floor and animal resources were located on the west side on the third and fourth floor.

Although the move to Tupper Hall represented a significant upgrade in the quality of research space, many faculty members, including both basic science and clinical science researchers, still needed to remain in the Surge 3 facility and in other temporary buildings. As faculty from the School of Veterinary Medicine occupied laboratories on the first, second and third floor in Tupper Hall, the School of Medicine basic science departments were limited to just over half the total laboratory and office space in the building. This resulted in the need to assign laboratory space to newly recruited faculty of the SOM clinical departments requiring Davis-based resources in Surge 3 or other temporary buildings on the campus. This lack of adequate space resources limited close research interactions of clinical science and basic science departments and remained a concern until completion of the GBSF facility in 2004 (see below).

The move into Tupper Hall was associated with a growth in research activity driven at least in part by the recruitment of new basic science chairs. Dr. Loren Carlson, a physiologist and basic science leader and basic science leader and associate dean from the inception of the school, passed away late in 1972. Following his passing, Dr. Eugene Renkin was recruited from Duke University in 1974 as chair of the Department of



Eugene Renkin

Physiology. During this time there was considerable faculty turnover with several faculty from this department leaving (Hsieh, Mason and others) while new recruits with strong research programs were recruited (Carlsen, Cala, Turgeon and Curry). These recruitments formed the nucleus of expertise in membrane transport, a theme that has remained as a leading research program for more than 40 years.

Dr. Allen Enders was appointed chair of Anatomy and Cell Biology in 1976. The move into Tupper Hall brought new resources in electron microscopy overseen by his department. Enders recruited new faculty (Carlsen and King), who, along with established faculty maintained strong research programs while still carrying a heavy teaching load. Dr. Edwin Krebs, founding chair of the Department of Biological Chemistry and the 1992 Nobel Prize winner, returned to the University of Washington in 1978 and Dr. Morton Bradbury was appointed department chair in 1979, establishing a major research component in nuclear magnetic resonance.



Edwin Krebs

Dr. Robert Stowell, the founding chair of the Department of Pathology, was additionally appointed as Director of the NIH-funded California National Primate Research Center and served in this capacity from 1969-1971. Dr. Sefton Wellings served as executive vice chair in the department until 1977, when Dr. George Lundberg, later editor-in-chief for *JAMA*, became chair. He recruited Dr. Murray Gardner; whose expertise in retrovirology became a cornerstone of AIDS research at UC Davis and the Center for Comparative Medicine, and who followed Dr. Lundberg as department chair in 1982. Dr. Gardner was succeeded as chair by Dr. Robert Cardiff in 1990 and by Dr. Ralph Green in 1996. The only basic science department that did not have a new chair during this period was the Department of Pharmacology and only one nontenure track faculty (Chuang) was recruited into the department during this period.



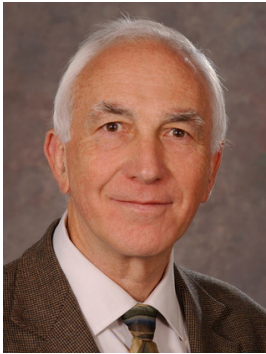
Allen Enders

While the opening of Tupper Hall and the new recruitments in the basic science departments on the Davis campus were in progress in the late 1970's and early 1980's, the development of research programs on the Sacramento Campus progressed at a slower rate. When Dr. Hibbard Williams in 1980 became the second dean of the School of Medicine, he and other senior leaders (who had been attracted to Davis by the opportunity to build a new academic medical center from the ground up) faced major challenges as limits to the hospital quality control oversight of the vascular and kidney transplant programs required their full attention. In collaboration with senior leadership in the clinical departments (Drs. Chapman, Blaisdell, Tupin, Castles, Rockwell, Keltner, and later Silva, deVere White, Chole and Goodnight), a major effort was undertaken to ensure the transformation of the former county hospital to a fully functional academic medical center that would meet all levels of clinical and academic accreditation. Those who worked through this period (documented in a number of retiree video records) acknowledge that these were challenging albeit necessary steps to prepare the Sacramento Campus for a future as a stellar academic health center and for the major research efforts that began in the 1990's.

Six chairs of the Department of Pathology – at left. Robert Stowell, and right (from left to right) George Lundberg, Robert Cardiff, Lydia Howell, Murray Gardner and Ralph Green



B. Research plan of the 1990's



**Roy Curry, the first
associate dean for
research**

As part of the creation of UCDHS, a joint Medical Sciences Planning office was created with the responsibility of developing and coordinating periodic updates of the school's academic plan and the UCDMC administrative plan. Long-range plans for the school and the hospital were developed separately through this effort. As mentioned above, Dean Lazarus and Hospital Director Frank Loge agreed to launch a fully integrated strategic planning effort for both the school and hospital. The final report of this effort reaffirmed the faculty's strong belief in the primacy of the academic mission and that excellence in research was fundamental to establishing the identity of the UC Davis School of Medicine as an outstanding academic medical center. Creation of a new position of associate dean for research and a designated office of research was one of the recommendations of the Strategic Plan.

Prior to this time, the research administration was focused on grant submissions and sponsored programs (see separate section). The following is a summary of the document "Overview of Research Program: Planning, Major Initiatives, and Infrastructure Issues," prepared by the newly appointed associate dean Fitz-Roy E Curry (at the time chair of the Department of Physiology, succeeding Dr. Renkin) and his principal staff members, Don Martensen and Ted Wandzilak. The document was part of the presentations at the School of Medicine Colloquy with the Office of the Provost, Dr. Robert Grey, on March 6, 1997.

The report summarized seven strategies for research development. These included strategies to allocate state-funded FTE faculty positions, space, and support for new research in ways that benefited existing areas of strength at the time (cardiovascular medicine, rheumatology, nutrition, vision sciences, retrovirology, epidemiology, orthopedics, and basic cell and molecular biology), as well as promoting critical masses of NIH funded faculty in clinical and basic sciences departments. Particular attention was paid to areas that overlapped with campus programs, recently endowed chairs, and programs relocating to Davis or Sacramento.

On the basis of these criteria, the areas nominated for immediate priority for programs based on the Davis campus were: (1) Broad renewal of the basic sciences departments by recruitment of junior faculty; (2) Recruitment of leaders and new faculty in molecular medicine and human genetics (utilizing Rowe Chair resources); (3) Recruitment of a director and faculty to the Center for Comparative Medicine, a program shared with the School of Veterinary Medicine; (4) Linkage of human nutrition research to programs in the College of Agriculture and Environmental Sciences, building on the existing NIH-funded Clinical Nutrition Research Unit (CNRU), under the directorship of Dr. Charles Halsted, a national leader in nutrition research; and (5) Recruitment of a new director and faculty in the Center for Neuroscience (see below).

For programs based on the Sacramento campus, priorities were: (1) Building a Cancer Center Basic Biology Program; (2) Developing the Bone Biology program in Orthopaedics (centered around Ellison Chair resources); (3) Wound healing and Tissue Repair Program in coordination with Shriners Hospital; and (4) further development of the Center for Health Services Research in Primary Care, established in 1994 with Dr. Klea Bertakis as the founding director, and later renamed in 2006 as the Center for Health Care Policy and Research.

An important initiative launched at this time was the establishment of an intramural Health System Research Award program, supported by the hospital director. Over six years, more than \$12 million was awarded to help build competitive research programs and grow NIH funding levels. As the program was sunsetted in 2004, the return on investment in extramural funding was more than four-fold.

By early 1997 the progress and evaluation of these initiatives was summarized as follows:

For the Davis campus, an NIH grant to renovate laboratory facilities for new faculty as well as to update core facilities was successfully funded. The basic sciences departments had formed a Basic Science Council which coordinated recruitment of four new faculty, of which two were affiliated with genetic programs. This program was later expanded to focus on additional recruitment in Membrane Biology led by Dr. Peter Cala, chair of the Department of Physiology succeeding Dr. Curry. The program was expanded further with the efforts to revitalize the Department of Pharmacology a few years later with the appointment of Dr. Ann Bonham, at the time head of the division of Cardiology in the Department of Medicine, as chair of Pharmacology, and provision of resources to recruit several new faculty. Dr. Michel Seldin had been recruited to the Rowe Chair in Human Genetics along with new faculty (Dr. Craig Warden), with FTE resources shared from the Department of Pediatrics.



From left to right: the Research III building in Sacramento and the USDA Western Human Nutrition Research Center in Davis

The School of Medicine was evaluating preliminary plans for a Center for Molecular Medicine next to Tupper Hall, which was later realized as the Genome and Biomedical Science Facility (GBSF) building and completed in 2004. The US Department of Agriculture was preparing to move the Western Human Nutrition Research Center from the Presidio at San Francisco to UC Davis campus, an effort led by the director, Dr. Janet King. After some years in temporary buildings, in 2004 the Center moved into a new facility constructed next to GBSF, and Dr. King was succeeded by Dr. Lindsay Allen. A search was also ongoing for a new director of the Center for Neuroscience in collaboration with the Division of Biological Sciences (later College of Biological Sciences).

For the Sacramento campus-based programs, the most active effort was the development of a program in Basic Biology in Cancer. To realize this program, 5000 sq. ft of space in the new Research III building was allocated to the program. Dr. Ralph de Vere White was appointed as Cancer Center director in 1995 (see below) and funding to recruit a deputy director in charge of the Basic Science Program was underway with strong support from Hospital Director Frank Loge.

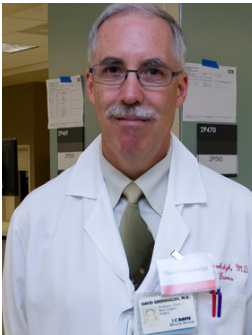
An intramural program for research funding to support basic and clinical cancer investigators (supported by the American Cancer Society) was in its second year of funding at this time. The Bone Biology and Tissue Repair programs were being developed by the recruitment of Dr. Hari Reddi in Orthopaedics and Dr. David Greenhalgh to the new Shriners Hospital, construction of which was nearly completed. A search for a director of the Shriners research program was underway and resulted in the recruitment of Dr. David Pleasure from the University of Pennsylvania. In the coming years, the research at Shriners Hospital grew substantially, including the establishment of a Burn Research Center, led by Drs. Greenhalgh and Tina Palmieri, a leading burn surgeon.



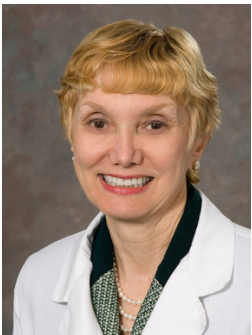
The plan for the UC Davis Cancer Center (now UC Davis Comprehensive Cancer Center).

Dr. Richard Kravitz was appointed as director of the Center for Health Services Research (later renamed Center for Health Care Policy and Research) in 1996, following Dr. Bertakis. In 1999, during Dr. Kravitz's time as director, the center was awarded status as a formally recognized UC Davis Organized Research Unit (ORU), the only other such unit in the SOM being the Cancer Center. Dr. Kravitz served until 2006; in 2013 he was appointed initially as interim and in 2015 permanent director of the UC Center Sacramento. Following Dr. Kravitz' departure in 2006, Dr. Bertakis stepped in as interim director after a brief period with Dr. Jill Joseph as director, followed in 2009 by the appointment of Dr. Joy Melnikow who served until 2021.

A School of Medicine space plan for allocation of laboratory and dry research space was developed and demonstrated a fundamental shortage of space for both existing faculty and the proposed recruitment of new faculty. There was also an urgent need for critical research infrastructure. Priorities at the time were a Mouse Biology Program to support the growing use of genetically modified mice and upgraded facilities for flow cytometry, cell sorting and high-resolution microscopy. These needs were evaluated by Davis and Sacramento campus committees. As described elsewhere, the Mouse Biology program became a reality in 1997 under the leadership of Drs. Stephen Barthold and Kent Lloyd at the Center for Comparative Medicine; flow cytometry resources were developed on both the Davis and Sacramento campuses.



From left to right: David Greenhalgh, David Pleasure and Tina Palmieri



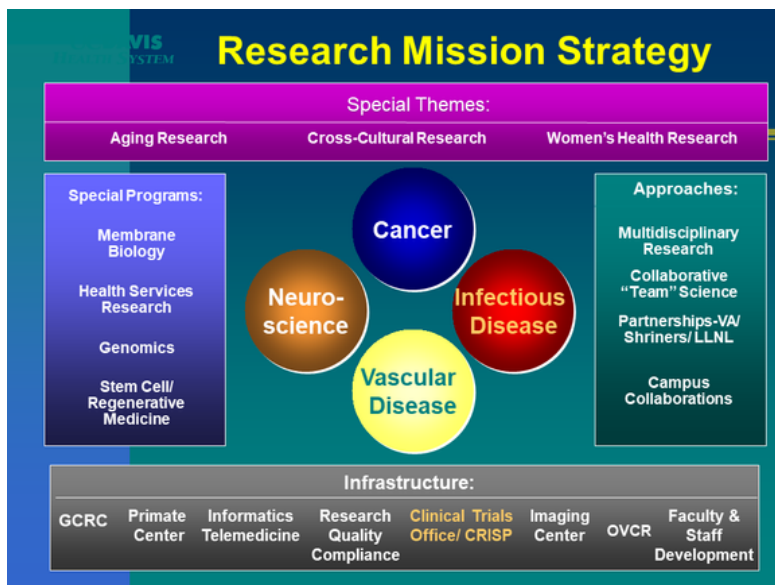
From left to right: Klea Bertakis, Richard Kravitz and Joy Melnikow

Taken together, these initiatives represented the largest investment in research programs, faculty, and infrastructure since the inception of the school. The self-study report of late 1997 for the LCME accreditation provides a further faculty evaluation of these programs and the plans to build on these recommendations. Planning had started to address the need to build the critical mass of clinical investigators needed for an application to NIH for a General Clinical Research Center; the campus and NIH were reviewing the construction project funded by an NIH grant to renovate laboratories in Tupper Hall; and the proposed SOM Center for Molecular Medicine to be built north of Tupper Hall (i.e., the future GBSF) was in the early planning stages. This project was later expanded to house the newly formed Department of Biomedical Engineering, faculty representing basic and clinical science research in the SOM, faculty in the Genome Center and faculty from the College of Biological Sciences. These plans were realized by the construction of the 100,000 sq. ft GBSF in 2004, representing a unique facility that has remained a key centerpiece for interdisciplinary biomedical research at UC Davis over a close to 20-year timespan.

C. Medical research at the UC Davis Health System at the time of the 2004 strategic plan.

By the mid-1990's, UC Davis Health System started to increasingly target national preeminence in research. The 1995 strategic plan for research outlined institutional priorities and overarching goals for UCDHS research programs for the coming decade. Strategic decisions were made to invest in the expansion of research faculty and infrastructure. This was facilitated by a relatively favorable national funding environment for medical research. Steady investments were made in the research enterprise and at the beginning of 2004, which marked the end of the 10-year strategic plan from 1995, biomedical research at the health

system generated \$101.6 million in annual funding from extramural sponsors, including federal and state agencies, private foundations and industry (see separate section). Notably, resulting from this strategy the research growth accelerated with an increase in the portfolio of extramural research grants and contracts by 23.2% and 40.6% in fiscal years 2001-02 and 2002-03 respectively. In 2004, about 550 independent research projects were ongoing, representing a complete spectrum of research that included fundamental laboratory studies of cellular processes, pre-clinical studies of potential new therapies and diagnostics, clinical trials of new drugs in human patients, population-based studies of disease patterns, and analyses of health care public policy.



The central research theme for the 2004 Health System strategic plan

At this point it was realized that meeting the goal of becoming a top national research institution would require a more than doubling of the funding-base of the research enterprise, and by extension, nearly doubling the size of research faculty and facilities infrastructure. At the time, UCDHS was ranked 53rd of medical schools, which was in the top half of the 126 U.S. medical schools, and the school was on a strong trajectory upwards. It was clear to the UCDHS leadership that a continued advancement in ranking and prominence would require both substantial investments of new resources and an expansion of collaborative efforts with potential research and business partners. At the end of the 10-year strategic plan from 1995, the research programs that had been developed were drawing substantial benefits from partnerships with a number of external partners, including the Lawrence Livermore National Laboratory, the Veterans Affairs Health System, Shriners Hospital, and others. However, with some exceptions, there was less focus on partnering with other UC Davis schools and colleges. Due to the establishment of key research centers in the early 2000's, the opportunities for intra-campus and inter-UC collaborations were increasing.

A new UCDHS strategic plan adopted in 2004 under the leadership of Executive Associate Dean Pomeroy provided a road map for focusing investments during the coming decade in four specific research areas, as well as various cross-cutting themes, approaches and enabling technologies and services. The top four areas identified at the time were Cancer, Vascular Medicine, Infectious Diseases, and Neuroscience. With the benefit of hindsight, it can be noted that each of these areas currently represent top global research areas, with a particular increase in attention to infectious diseases in recent years.

Based on the interest in growing collaborative efforts, priority was placed on developing several cross-cutting themes that span all four of the above focus areas. Key themes identified were Aging, Cross-Cultural Medicine and Women's Health. This choice has stood the test of time as each has increasingly come into focus in recent years, close to 20 years after the adoption of the strategic plan.

The plan also recommended selective investments in several scientific thematic areas. The selection of these was based on being a scientific sub-discipline that would bring specific scientific tools and methods to bear on a variety of research areas. It was envisioned that each of the scientific themes would have the potential for dramatically increasing knowledge in all four focus areas described above, as well as leveraging existing strengths. The thematic areas identified were Membrane Biology, Genomics, Stem Cells/Regenerative Medicine and Health Services Research. Over time, a number of research initiatives and centers have developed in several of these areas and they now, 20 years after adoption of the plan, represent significant pillars for the research enterprise.

To realize the goals of the strategic plan, a number of scientific approaches were emphasized that could serve as engines for future growth. It was well understood at the time that scientific innovation would increasingly depend on the application of multiple scientific disciplines and expertise to a problem, and that collaborative efforts could substantially leverage individual institutional resources, a concept congruent with the present focus on team science. The plan aimed to specifically encourage Multidisciplinary Approaches to Research Topics, Large-Scale, Team-Oriented Science (as opposed to projects driven solely by the efforts of individual scientists), External Partnerships (with industry and other academic, governmental or non-profit research institutions), and crucially UC Davis campus collaborations (i.e., leveraging the expertise and resources of other UC Davis scientists, such as those in Veterinary Medicine, Biomedical Engineering, Biological Sciences, Agriculture and Environmental Science and others). This is coming to fruition with the developing Aggie Square project that centers around both campus collaborations and the engagement of external partners.

Importantly, the 2004 strategic plan realized that future growth would depend on having an appropriate supportive infrastructure. The plan anticipated that an enhancement of patient-focused clinical research would represent a major opportunity for substantial growth. As large-scale research would require specialized administrative and technical support systems, the development of a number of support centers and resources was seen as vital. Such resources were anticipated to include a General Clinical Research Center (a partnership with the VA Health System's Mather Hospital); a Clinical Trials Office (for marketing, training and coordination) with a focus on quality compliance; a unique Clinical Translational Research Investigator Support Program (CRISP), a program that provided one-stop shopping for essential researcher services, including biostatistics and large database management; expansion of the Telemedicine Program; established collaborations with the California National Primate Research Center (supporting a wide variety of pre-clinical developmental studies); a Research Imaging Center; and a portfolio of Faculty/Staff Development programs (especially targeting the research training of physician scientists).

At the time of the inception of the strategic plan, many of these planned activities were already ongoing. More detailed descriptions of major research areas are covered in later sections on specific research centers. Some of the developments in the early 2002 are summarized below:

The UCDHS Cancer Center (now the UC Davis Comprehensive Cancer Center) achieved official NIH designation in 2002. As part of the partnership between the Cancer Center and Lawrence Livermore National Laboratory to house an NSF-funded Center for Biophotonic Science and Technology, construction was initiated on an expanded Sacramento research facility (Oak Park Research Building).



Oak Park Research Building

Due to NSF rules, the center was sunsetted after two funding cycles, but the progress made resulted in subsequent partnerships with the College of Engineering (see below). In addition, since the inception of the Comprehensive Cancer Center, Lawrence Livermore National Laboratory has remained a critical center partner.

Active planning and recruitment got underway for the expansion of programs, personnel and facilities dealing with vascular diseases. However, due to recruitment difficulties and the successful application to support the Stem Cell program, the initiative in vascular research was

delayed until the mid-2010s, at that time supported by Dean Julie Freischlag.

The nationally recognized UC Davis Center for Neuroscience was at the time already highly ranked. The UC Davis MIND Institute (focused on neurodevelopmental disorders) opened in newly constructed Sacramento facilities in 2003 and has rapidly emerged as a national resource with a number of center grants (see below for more detailed descriptions).

The recruitment of Dr. Cameron Carter from the University of Pittsburgh to lead a new UC Davis Research Imaging Center in Sacramento led to growing support for a variety of neuroscience studies by permitting high-resolution functional MRI of the brain and has served as an integral foundation for the neuroscience focus area.



Satya Dandekar and Demosthenes Pappagiannis

Strong basic, translational and clinical research programs in HIV/AIDS were an early hallmark of UC Davis infectious diseases programs with a strong cadre of investigators, including Dr. Murray Gardner, at the Center for Comparative Medicine. The institution received funding for a Developmental Center for AIDS Research but the center did not transition into a mature center. In its place, the infectious diseases focus in the strategic plan has consistently been supported by a strong track record of individual investigators, including the nationally recognized research program of Dr. Satya Dandekar, chair of the Department of

Medical Microbiology and Immunology, on HIV and mucosal immunology. Other strong contributions have been made by Drs. Andreas Bäumlér and Renee Tsohis on the interaction between salmonella and the intestinal epithelium and the work of Dr. Janine LaSalle on epigenetics and autism. The department also houses a unique program focused on valley fever, initiated by the founding chair Dr. Demosthenes Pappagiannis and later led by Dr. George Thompson, an infectious disease clinician.

As discussed above, the Membrane Biology program has served as a strong, common thread linking several basic science departments, primarily Pharmacology and Physiology. The recruitment strategy has been successful and has netted several chairs with a focus in this area, such as Dr. Donald Bers from Loyola University as chair of Pharmacology (after Dr. Bonham was appointed Executive Associate Dean in 2005) and Dr. Fernando Santana from the University of Washington in Physiology (after the retirement of Dr. Cala).

The Department of Cell Biology and Human Anatomy has historically carried an extensive teaching load as well as providing important core services. With the appointment of Dr. Paul FitzGerald as chair in the 2000s, a strong focus on vision science emerged. Key leaders in vision science such as Drs. Marie Burns and Edward Pugh were recruited and collaborations were established with the Department of Ophthalmology, led by Dr. Mark Mannis, who encouraged clinical faculty to establish research collaborations with their basic sciences counterparts. In addition to ongoing ocular research in Sacramento by Dr. John Werner, Department of Ophthalmology faculty such as Dr. Larry Hjelmeland established research programs in Davis. Joint vision science recruitments (Drs. Christopher Murphy and Sara Thomasy) were also made with the School of Veterinary Medicine. The establishment of the Ernest E. Tschannen Eye Institute in Sacramento in 2022 and the recruitment of the long-standing director of the National Eye Institute, Dr. Paul Sieving, has led to the start of novel research initiatives.

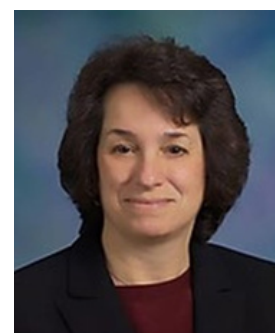


Donald Bers and Fernando Santana



Paul FitzGerald and Mark Mannis

The emphasis on women’s health has been incorporated in a number of initiatives and adopted in multiple cross-campus interactions under the leadership of Drs. Amparo Villablanca and Lydia Howell. Notably, a K12 program for developing researchers focused on women’s health (Building Interdisciplinary Careers in Women’s Health), initially led by Dean Pomeroy and later by Drs. Nancy Lane and Ellen Gold, has a long-term track record of NIH funding and has been important in growing future researchers (see research training section).



*From left to right:
Amparo Villablanca,
Lydia Howell, Nancy
Lane and Ellen Gold*

The UC Davis Genome Center has developed into an important campus resource. It started as one of the three main groups occupying the Genome and Biomedical Sciences Facility (GBSF) in Davis that opened in 2004. GBSF has over the years emerged as an interdisciplinary hub for UC Davis, bringing together several departments of the School of Medicine, the Department of Biomedical Engineering from the College of Engineering, and faculty from multiple schools and colleges belonging to the Genome Center. This co-localization has promoted the development of several strong and nationally significant interdisciplinary advances. Under the leadership of the founding director, Dr. Richard Michelmore, the Genome Center was developed as a “technological antenna” for campus, bringing new genomic technologies to campus and helping constituencies across campus incorporate them into their research programs. A central focus for the center was to provide strong core services in genomics, proteomics bioinformatics and metabolomics. In recent years, there has been a growing strength in genomic approaches focused on human health issues. During the two years of the pandemic, the Genome Center provided a critical community and campus resource for doing COVID testing in collaboration with the Healthy Davis Together program. Several other

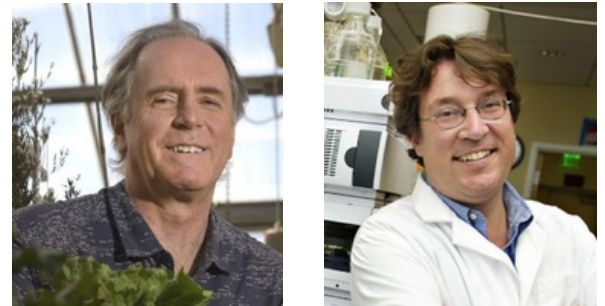


UC Davis GBSF, housing the Genome Center and researchers from three School of Medicine departments.

well-funded research programs have been developed in the GBSF building; under the leadership of Dr. Oliver Fiehn, recruited from Germany, the Metabolomics component has been very successful, and a large NIH center has been established.

Another major resource developed was a small animal imaging facility in the GBSF basement under the leadership of Biomedical Engineering faculty, including Dr. Kathleen Ferrara and Dr. Simon Cherry, recruited from UCLA, who pioneered micro-PET. Other notable researchers included Drs. Julie Sutcliffe and Abhijit Chaudhari, who has developed novel research programs based on small animal imaging. This unit has interacted strongly with the Primate Center as well.

UC Davis opened inland Northern California's first General Clinical Research Center (GCRC) in 2004, in partnership with the new Veterans Affairs Medical Center, Sacramento, located in Mather. As described elsewhere, the application submitted for a NIH-funded GCRC center grant in 2003 was successful, with funding starting in 2004. This center transitioned in 2006 into one of the 12 inaugural national CTSA centers.



Richard Michelmore and Oliver Fiehn

A unique Clinical and Translational Research Investigator Services Program (CRISP), largely envisioned by then Executive Associate Dean Pomeroy, was initiated in 2003 to serve as a unique "one-stop shopping" resource for investigators conducting either NIH or industry-sponsored clinical or translational research. The program was co-located with the investigator support functions of the GCRC and its presence was a major proof of concept that facilitated CTSA funding in 2006. It transitioned into being a key part of the UC Davis CTSC.

Early on, the UCDHS developed a Business Technology Development unit that closely interacted with the Office of Research on campus. Realizing the need to develop training resources for faculty, the School of Medicine and the CTSC further enhanced this focus which included funding as the trailblazing group of centers receiving NIH iCorps funding. Collectively these activities constituted a strong development initiative which is being incorporated as part of the campus Aggie Square program.



The plan for the Aggie Square development in Sacramento.



Center for Neuroscience, located in South Davis

Research Centers on the Davis Campus

Center for Neuroscience

Under the leadership of Dr. Robert Grey, dean of the Division of Biological Sciences (1985–1993) and later UC Davis Provost, and a small cadre of faculty neurobiologists, the Center for Neuroscience (CNS) was established in 1992 as the first interdisciplinary research center at UC Davis and one of the first neuroscience centers in the country. Several colleges and schools have consistently supported the center and, traditionally, the director reports to the provost and a lead dean, in this case the dean of the College of Biological Sciences.

Over the past 30 years, CNS has had strong growth, hiring 42 core faculty under the leadership of five Center directors (Michael Gazzaniga 1992-96, Leo Chalupa 1996-98, Ted Jones 1998-2009, Cameron Carter 2009-16 and Kimberley McAllister 2016-present). The latter four all had appointments as faculty in the School of Medicine. Contributing to its interdisciplinary approach are center faculty members, students, and collaborators who represent 13 academic departments and sections on the main campus and a number of other sites. Visiting faculty members from around the world bring additional outstanding talent to the center's programs.



Five directors of the Center for Neuroscience, from left to right: Michael Gazzaniga, Leo Chalupa, Ted Jones, Cameron Carter and Kimberley McAllister

Research at the center is diverse, covering the major sub-disciplines and techniques in neuroscience. Center faculty places special emphasis on sensory physiology, on the molecular-genetic basis of neuronal function and its development, on the search for genetic markers in psychiatric diseases, in addition combining information obtained from different brain-imaging techniques, including fMRI, and ERPs, for the study of human cognition and the development of improved methods to treat brain injury and disease. The in-house faculty conduct research across a wide range of neuroscience approaches and subfields, from genetics and molecular biology to cellular, systems, cognitive and translational neuroscience. A number of cross-cutting themes engage faculty working at different levels of analyses, including neurodevelopment, synaptic plasticity, learning and memory and perception and decision-making. These links create synergies among faculty and their laboratory groups that are based on their co-location at the Center, and this is reflected in their many collaborative projects, grants and scientific papers.

In addition to its role as an incubator of outstanding research, the center is the UC Davis' hub for basic neuroscience research and graduate training. It brings together the 21 in-house research groups with more than 60 additional lab groups from across the undergraduate and medical school campuses as affiliate members, enriching collaborative opportunities and increasing the breadth and depth of neuroscience research at UC Davis.

Through hosting many academic and outreach events, the center anchors the UC Davis neuroscience community and departments and schools across campus as well as local industry and community groups. Attesting to the prominence of neuroscience at UC Davis, the institution was awarded a Silvio Conte award from NIMH in basic neuroscience under the leadership of Dr. Carter in 2016. The grant was successfully renewed in 2021 and the focus of the present grant period is to discover how infections during pregnancy, such as COVID-19 and influenza, can lead to psychiatric illness and developmental disorders in offspring years later, and how to detect, prevent or treat these disorders.

California National Primate Research Center (CNPRC)

The seven regional US primate research centers were established by congressional mandate during the 1960s and are now funded by the National Institutes of Health (NIH). The primate centers are distributed throughout the United States, and together they maintain more than 18,000 nonhuman primates representing 32 species. From the beginning, the primate center in Davis was intended to serve the broader California and western region. Congress specified a number of objectives for these centers including: (1) to develop nonhuman primate models for basic and clinical research and to examine the underlying mechanisms and processes of human health problems and diseases, (2) to establish a resource for scientists from many disciplines who are trained in the use of primates and to ensure both the continuity and the high quality of scientific research based on primate models, (3) to develop improved breeding practices that more adequately meet the overall research demands of the centers for high-quality, disease-free primates, (4) to provide opportunities for research experience to graduate students; postdoctoral fellows; visiting scientists; faculty members; and medical, dental, and veterinary students, (5) to study natural diseases of primates and techniques of importation conditioning, housing, and management, which improve the well-being and suitability of the research primate, (6) to supply biological specimens to biomedical investigators, and (7) to disseminate findings of center-supported studies to the biomedical research community. In hindsight, virtually all of these objectives have proven critical to advance understanding and treatment of both chronic and emerging diseases.

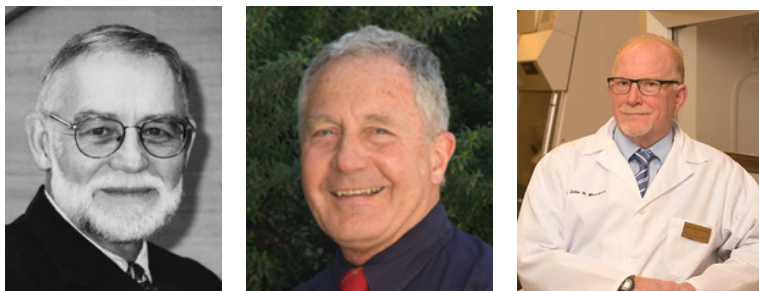
When the primate center program began, each new center had an identifiable focus, which often was linked to a particular species of primate. The UC Davis Primate Center began in 1962 as the National Center for Primate Biology, primarily to serve as a breeding colony of healthy animals for research and to be the primary center responsible for addressing aim 3 above. Over time it has provided resources to other primate centers and houses about 4-5,000 primates, mostly rhesus macaques. The center has advanced conditions for housing and associated husbandry to ensure the healthiest of environments for the animals.



California National Primate Research Center

From early in its history, the center has significantly improved the quality of nonhuman primate research and nonhuman primate care. As the centers have matured, there has been an increasing overlap regarding the focus of research. Despite this merging of some activities, each primate center still maintains some of its original orientation. Perhaps the major influences on the scientific programs of a primate center are the research interests of the director and core faculty, the research strengths of the institution, and the availability of funding for particular types of research.

From its inception, the center reported to the vice chancellor for research. Over time, it has increased its collaboration with the Schools of Medicine and Veterinary Medicine and other UC Davis schools and colleges and draws core scientists and other faculty broadly from campus departments. The Primate Center has continued to improve and evolve, and in 2002, it was renamed the California National Primate Research Center (CNPRC) to focus on the role the Center plays in providing resources on a national level for human health-related research. The center's research units are focused on four primary topics: brain, mind, and behavior; infectious diseases; reproductive sciences and regenerative medicine; and respiratory diseases. School of Medicine faculty have served as unit leaders (e.g. Drs. Peter Barry, Paul Luciw and Alice Tarantal) and the interactions between the center and the school have consistently grown. This was particularly pronounced from the time when Dr. Dallas Hyde in 2000 succeeded Dr. Andrew Hendrickx, who had served as director from 1987. This increased partnership between the center and the school resulted in part from the funding of the GCRC and later the CTSC, as the Primate Center and the GCRC and CTSC were all funded by NCRR, and the NIH encouraged local interactions. This close relationship continued under Dr. Hyde's successor, Dr. John Morrison, recruited from the Mt. Sinai School of Medicine, who assumed the leadership in 2016 after a period of interim leadership by Dr. Peter Barry, a School of Medicine faculty member.



From left to right: Andrew Hendrickx, Dallas Hyde and John Morrison

Over the 55-year history of the CNPRC, countless breakthroughs and contributions to medicine have been made. Important CNPRC research contributions include the following:

- The center played a key role in the development and testing of antiviral therapies such as tenofovir which has become a key ingredient of successful prophylaxis and is one of the most commonly used anti-HIV drugs in the world.
- Key findings demonstrated an association between environmental tobacco smoke exposure and adverse effects on prenatal, neonatal and childhood lung development, cognitive function and brain development.
- Research at the CNPRC has shown that exposure to high levels of fine particle pollution (e.g. wildfire smoke) adversely affects both development of the immune system and lung function.
- The understanding of developmental timelines in the kidney, and application of these findings to tissue engineering approaches to regenerate kidneys damaged by obstructive disease.
- Novel development of therapies at the CNPRC are being used to treat patients with Alzheimer's Disease. Ongoing research is focused on reversal of damage and restoration of brain function.
- The center has supported studies in young monkeys for IND (Investigational New Drug) applications for treating children with Pompe disease.
- A vaccine modeling Human Cytomegalovirus (HCMV) infection proved safe and effective with the rhesus macaque model and developed the first-of-its-kind approach to preventing HCMV infection inducing broader immunological protection.
- In a major advance, the presence of maternal auto-antibodies was associated with increased risk of a child having autism.
- In order to successfully treat human disease with stem cells, physicians will require safe, reliable, and reproducible measures of engraftment and function of the donor cells. Studies at the CNPRC have revolutionized the ability to monitor stem and progenitor cell transplant efficiency in fetal and infant monkeys using new noninvasive imaging techniques that demonstrated long-term engraftment and safety.

Center for Comparative Medicine and Mouse Biology Program



The Center for Comparative Medicine, located next to the California National Primate Research Center

In the late 1990s, ground was broken next to the Primate Center for the Center for Comparative Medicine (25,000 sq. ft) and in partnership with the School of Veterinary Medicine, Dr. Stephen Barthold, a prominent researcher in Lyme Disease, was recruited as director from Yale University and six additional faculty were recruited through this partnership. The center has historically shared affiliation with the Schools of Medicine and Veterinary Medicine, with faculty drawn from departments in both schools. The School of Medicine faculty have primarily been from the Departments of Medical Microbiology and Immunology, and Pathology. Examples include Drs. Jay Solnick (MMI) and Robert Cardiff, Peter Barry and Alexander Borowsky (Pathology).

The work by Drs. Cardiff and Borowsky has focused on mouse pathology. A mouse biology program was started by Dr. Kent Lloyd in collaboration with Dr. Barthold, who participated in a national network of four centers within the Mutant Mouse Regional Resource Center (MMRRC) Program, established by NIH in 1997. The MMRRC at UC Davis is made up of contributions from several campus resources and units, including the UC Davis Mouse Biology Program, the Center for Comparative Medicine and the Center for Laboratory Animal Science.



From left to right: Stephen Barthold, Kent Lloyd and Robert Cardiff

The MMRRC, relocated to a designated Davis-based facility, provides a host of services including importation of mouse strains by rederivation, cryopreservation, and reanimation of frozen embryos and germplasm, assisted reproduction techniques (IVF, ICSI, ICNI), and comprehensive genotyping (including speed congenics) and phenotyping (pathology, behavior, clinical pathology, etc.) capabilities. The School of Medicine provided key funding to offset the high cost of modified mice for the Cancer Center, Bone Biology, and collaborative projects with Biomedical Engineering. Under Dr. Lloyd's leadership, the facility has continuously received NIH funding and has served as a national resource.

Public Health Research



From left to right: Mark Schenker, Laurel Beckett, Bradley Pollock and Rachel Whitmer

As UC Davis does not have a School of Public Health, the Department of Public Health Sciences has from its inception served as a core and a nexus for research and education focused on public health. A long-term chair, Dr. Mark Schenker, established a strong research program focused on farm workers, air quality and health with extensions throughout the state. Under his leadership, a division of biostatistics was established with the recruitment of Dr. Laurel Beckett from Loyola University as its leader, partnering with Dr. David Rocke. The recruitment of Dr. Beckett was critical in providing a solid biostatistical resource for several large centers, including the Cancer Center and the CTSC. This division has grown to become a crucial underpinning of the research program of the school. Closely thereafter, Dr. Irva Hertz-Picciotto was recruited from the University of North Carolina to the division of epidemiology. She has developed an extensive research program that relates to autism and environmental health and led the effort to establish the Environmental Health Science Center (see below). Under the leadership of Dr. Bradley Pollock, recruited from the University of Texas, San Antonio in 2013, the department has continued to develop its research capabilities and is now one of the most well-funded departments in the School of Medicine. This was further underscored by the recruitment of Dr. Rachel Whitmer from Kaiser Permanente as co-Director of the Alzheimer Disease Center. Her extensive research program significantly enhanced its outreach activities.

Environmental Health Science Center



Dr. Irva Hertz-Picciotto and an example of California wildfires

The center was founded and received NIH funding in 2015 under the leadership of Dr. Hertz-Picciotto in the Department of Public Health Sciences. The mission of the UC Davis Environmental Health Sciences Center (EHSC) is to advance the understanding of environmentally induced disease and disability

and to translate this knowledge into interventions, new practices or policy changes that reduce those exposures or mitigate their effects on health. The center brings together researchers in multiple schools and colleges and it has been an important resource in addressing health issues arising from wildfires as well as understanding the relationship between environmental factors and a broad range of diseases, such as autism. The EHSC research spans molecular biosciences, environmental science, engineering, pathophysiology, biostatistics, epidemiology, and community development, with relevance to human conditions. Already, the EHSC has transformed interdisciplinary collaboration, attracted both new and established investigators, and placed environmental health on the radar of other centers throughout UC Davis. Increasingly, EHSC members are engaging with community stakeholders and seeking to address community-driven questions.

A few highlights of EHSC accomplishments are: 1) a novel vivarium facility for air pollution health studies using real-time air pumped from a heavily trafficked tunnel; 2) a program of research on exposures and health effects in response to destructive wildfires now commonplace throughout the western U.S.; 3) recruitment of many new investigators and establishment of a strong presence on social media. Guided by the NIEHS 2018-2023 Strategic Plan and the NIEHS Translational Research Framework, the Center has adopted three overarching theme areas: 1) interdisciplinary translational EHS linking molecular/cell culture experiments, whole animal assays, human epidemiologic research, interventions, and policy; 2) integration of environment, social justice and health to understand vulnerability and resilience; 3) building bridges with communities, clinicians, and policy-makers.

Layered on those broad themes are the historic UC Davis strengths in research on respiratory, nervous, immune, metabolic, endocrine, and reproductive systems, and recently expanding into cancer and climate-related health research. The center has a Pilot Projects Program and four cores: Administration, Integrative Health Sciences, Exposure Sciences and Community Engagement, as well as various advisory committees.

In the present funding period to 2025, the UC Davis EHSC is expanding its scope and impact by 1) advancing cutting-edge research in exposure characterization, environmental health effects, their molecular biologic mechanisms, and technology development for improving measurement of exposures and biomarkers; 2) enlarging the cadre of EHS researchers, and 3) engaging with policy-makers, community stakeholders and health professionals, to ensure relevance of our research and to translate findings into public health improvement. The center emphasizes inter-disciplinary and translational approaches to environmental health issues and is developing partnerships with other centers throughout UC Davis.



Comprehensive Cancer Center

Research Centers on the Sacramento Campus

While the campus had a well-deserved reputation for collaboration amongst individual faculty and cross-school research programs supported by multi-department graduate groups, there had been no mechanism until the 1990s to provide the necessary level of infrastructure investment to support major research programs on the Sacramento campus. The changes in managed care and the need for the hospital to distinguish itself from other local medical providers through excellence in specialty areas and academic research prompted the SOM and the hospital, under the leadership of Dean Lazarus and Director Loge, to launch a new era of support for research in both basic and clinical departments. To solve some of the space needs, three research buildings were created on the hospital grounds (Research I-III).

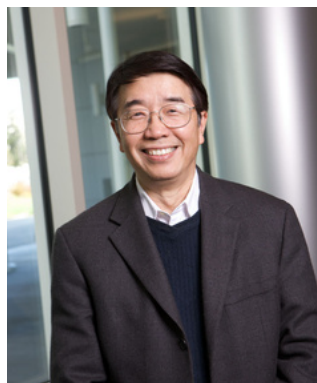
Initially these housed basic research programs in bone health, the Ellison chair resources and basic science cancer research. For some time one of the buildings housed the clinical laboratory facilities but was later allocated to support the growing research portfolio. Much of this development was anchored by the development of research centers representing UC Davis School of Medicine clinical strengths. In the following sections, we provide examples based on several interdisciplinary centers. While these are not the only instances of leveraging such strengths, they provide examples of the way the institution has been able to develop scalable resources grounded in a culture of interdisciplinary resource sharing.

Comprehensive Cancer Center

With strong support from Hospital Director Frank Loge and Dean Hibbard Williams, and under the leadership of Dr. James Goodnight, the UC Davis Cancer Center opened its doors in 1991. Based on nearly a decade of design and organizational work, the center consolidated many of the hospital's diverse cancer programs into a single outpatient treatment center. Besides enhancing excellence in clinical care, the cooperative and interdisciplinary nature of the Cancer Center afforded great opportunity to advance the School of Medicine research mission.

In 1993, to leverage the Cancer Center to enhance research productivity in the School of Medicine, Dean Lazarus convened a group of five prominent Cancer Center directors led by Dr. Al LoBuglio from the University of Alabama, Birmingham. The cancer programs represented by each of these directors had major core grant support from the National Cancer Institute, which gave them recognition as NCI Designated Cancer Centers. The assembled group was tasked to review the UC Davis Cancer Center and make recommendations for research development. They unanimously recommended the hire of a well-funded, highly recognized cancer investigator to be a lead scientist for development of the cancer research program. In addition, they were very impressed with Dr. Ralph deVere White's studies of tumor markers of prostate cancer for both assisting diagnosis and as therapeutic targets.

In response to this worthwhile review, Hospital Director Loge pledged five million dollars in support of hiring a lead scientist to boost research program development. Dr. Goodnight, together with the associate dean for research, Dr. Curry, were tasked with identifying potential candidates and resources needed for this lead scientist position. As they proceeded, the consistent message came forth that substantially more funding would be required for the proposed development, an increase on the order of ten million dollars. In the meantime, Dr. F. William Blaisdell, the prominent chair of surgery at UC Davis, who was instrumental in building a first-rate trauma program, stepped down. Dr. Goodnight was offered the opportunity to fill his position. He agreed to take on this responsibility if Dean Lazarus and Director Loge would appoint Dr. deVere White as the UC Davis Cancer Center Director. They agreed and in 1995, Dr deVere White assumed responsibility as Cancer Center Director.



From left to right: James Goodnight, Ralph deVere White and Hsien Jing Kung

Over the next two decades, Dr. deVere White devoted enormous energy and leadership to successfully developing the research component of the Cancer Center. With support from the hospital, Dr. Hsien-Jing Kung was recruited in 1998 from Case Western Reserve University as research director and lead scientist for the UC Davis Cancer Center. Dr. Kung had a commanding reputation for productive studies of the molecular biology of cancer including prostate cancer. In this recruitment, the commitment made to Drs. Goodnight and Curry and the support from the hospital leadership played a critical role. Dr. Kung moved quickly to establish a broad and vibrant program investigating genetic and epigenetic phenomena contributing to the development of cancer in humans. Key recruitments included Dr. Kit Lam, an expert in combinatorial chemistry applied to cancer biology and drug development.

As the Cancer Center advanced its research program, it also played a catalytic role in establishing other research programs and resources on the Sacramento campus. Examples include the creation of a designated Biostatistics resource in the Department of Public Health Sciences, separate from the Statistics department on the UC Davis campus.

In pursuit of the goal of NCI recognition and core grant funding, Dr. deVere White worked aggressively to build a partnership with the Lawrence Livermore National Laboratory (LLNL) and develop a highly sophisticated interactive technology program. The synergy brought by this partnership created other durable

initiatives on the UC Davis campus, further enhancing the burgeoning basic sciences program. This included the nascent Biomedical Engineering Department; several members of that department's faculty became active leaders in the Cancer Center with research programs focused on imaging and drug delivery. As part of the partnership with LLNL, physicians and scientists worked to transform technology developed for national defense into new cancer therapies, detection methods and prevention strategies. In the process, the Cancer Center achieved status as one of a handful of campus Organized Research Units directly reporting to the vice chancellor for research.

In an intense and highly competitive process in 2002, the Cancer Center achieved its prized goal of National Cancer Institute Designation. The fundamental piece of this recognition was a \$3.9 million core grant for funding over three years (with expected competitive renewal applications). The award was based on groundbreaking research, the productive partnership with LLNL, and demonstrated high quality in all programs including delivery of clinical care. This stimulus has been successfully leveraged for expanding research and funding and service to the community. The award also brought national recognition and validation of the overall institutional work in cancer research and patient care.

As the program expanded, a Center for Biophotonics, Science and Technology was established in partnership with LLNL and received funding from the National Science Foundation, as mentioned earlier. In strong support of this initiative, the Health System provided a designated building in Sacramento, adjacent to the medical center. At the Sacramento campus, the research program progressively drew other investigators from the UC Davis School of Medicine as well as the California Department of Health Services.

On the Davis campus, the Cancer Center developed partnerships with scientists from the School of Veterinary Medicine, the College of Agricultural and Environmental Sciences and the departments of Nutrition, Chemistry, and Biomedical Engineering, as well as the USDA Western Human Nutrition Research Center. Throughout its existence, and largely due to the leadership of Dr. deVere White, the center has become a cornerstone of the institutional research portfolio and is a sought-after partner for many campus activities. In addition, at Lawrence Livermore, home of the world's fastest supercomputer and most powerful laser facility, 40 scientists have been actively engaged in cancer research through the UC Davis Cancer Center research program.



Primo "Lucky" Lara, Director of the Cancer Center since 2018

To expand service to the community, an NCI expectation, the UC Davis Cancer Center established affiliate cancer centers in Merced (Mercy Cancer Center) and Marysville (Fremont-Rideout Cancer Center), as well as an infusion center in Roseville.

The Cancer Center successfully renewed its NCI core grant several times, culminating in achieving the coveted title of NCI Comprehensive Cancer Center in 2012 in recognition of expanded research and service to the community. At that time, only 40 centers across the USA earned that title, making this a watershed landmark for UC Davis and this community. The UC Davis Comprehensive Cancer Center continues to be both a world leader in research and a center for the best available treatment of cancer patients across Northern California under the leadership of Dr. Primo Lara, who succeeded Dr. deVere White in 2018.

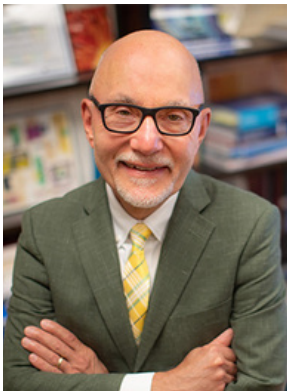
Beyond the importance of establishing a designated Cancer Center, this initiative paved the way for subsequent clinical research centers on the Sacramento campus. The need to establish service functions such as biostatistics, clinical research capabilities and informatics served to catalyze the development of other NIH-supported centers, such as the CTSC. An important lesson learned from this process was the realization by the UC Davis School of Medicine leadership that creating and sharing these resources leveraged the expansion of other programs. The synergy provided critical underpinning for future success.

MIND Institute

In 1997, four families of autistic children came together to seek a place where treatment would be available to their families, but found none. Two of the fathers, Chuck Gardner and Rick Hayes, formally approached UC Davis about establishing a neurodevelopmental research center. Within a brief period, and with the support of School of Medicine Executive Associate Dean Thomas Anders, UC Davis agreed to match private donations up to \$1.5 million to underwrite the endeavor. With the help and guidance of founding father Louis Vismara, pledges of financial support brought seed money for the project to \$3.7 million. Gardner and Rick Rollens, former secretary of the California senate and the parent of a child with autism, were instrumental in encouraging former state Sen. Diane Watson to introduce a bill in the legislature to establish the institute (Medical Investigations of Neurodevelopmental Disorders, or MIND) with an annual appropriation of \$2 million. The bill was signed into law by Governor Pete Wilson in August 1998. Two years later the state's budget would include a \$30 million appropriation to support the MIND Institute's research mission. The MIND Institute would go on to become known as "the house that collaboration built."



Robert Hendren



Leonard Abbedutto



The UC Davis MIND Institute

In 2001, Dr. Robert Hendren, recruited from the University of Medicine and Dentistry, New Jersey, was appointed as the inaugural executive director of the MIND Institute and the building housing the center on the Sacramento campus was completed in March 2003. Since that time, the MIND Institute has grown to become one of the leading neurodevelopmental research institutes in the United States, known for its transformational, paradigm-changing research. Some scientists, such as research director David Amaral and clinic director Robin Hansen, were involved from the outset in launching the MIND Institute. Together with researchers recruited from around the country, including Randi and Paul Hagerman, Sally Rogers and others, the MIND Institute's investigators have developed an unparalleled intellectual framework that has brought recognition and attention from around the world. A major advancement was the identification of FXTAS (Fragile X Tremor Ataxia Syndrome) by Randi and Paul Hagerman and their team in 2001, which has opened a whole new field of research and provided previously unrecognized links to autism spectrum disorders.



Five prominent MIND researchers, from left to right: David Amaral, Robin Hansen, Randi Hagerman, Paul Hagerman and Sally Rogers

After a period of rapid growth, Dr. Hendren stepped down in 2009 and Dr. Leonard Abbedutto from the University of Wisconsin, an expert in Down's syndrome research, was appointed as the second director in 2011. The MIND Institute has continued to be engaged in high-impact, multidisciplinary, collaborative research across a range of fields. It has become an intrinsic part of the research framework at UC Davis with strong links to departments and centers located on the Davis campus. Research studies taking place at the MIND Institute include basic science and clinical studies with participants from infancy, childhood and adolescence through young adulthood and late middle age. Areas of inquiry include autism, fragile X syndrome, attention-deficit/hyperactivity disorder, Down syndrome and 22q11.2 deletion syndrome. This research includes nationally recognized studies such as the Early Autism Risk Longitudinal Investigation and the Markers of Autism Early Risk in Babies Learning Early Signs studies, as well as groundbreaking treatment studies, such as those focused on the Early Start Denver Model and drug treatments for fragile X syndrome. The MIND Institute anchors a number of centers, such as one of the few NIH-supported Intellectual and Developmental Disabilities Research Centers and a Center for Excellence in Developmental Disabilities. Over the two decades of its existence, the MIND Institute has not only become nationally and internationally respected, but it has also served a catalytic function in advancing research at the Sacramento campus.

GCRC and CTSC - Expanding the UC Davis Clinical Research Footprint

At the turn of the century, UC Davis did not have a designated centralized resource to facilitate and conduct clinical research. A number of funded studies were ongoing, but they relied on the resourcefulness of the research leaders in finding the necessary space for patients and staff. At the same time, the General Clinical Research Center (GCRC) program of the NIH's National Center for Research Resources had been in place for close to 40 years. These GCRCs provide highly specialized research staff and facilities for multidisciplinary patient studies. Many, if not all, leading academic medical centers had one of these programs, the first funded at several leading US teaching hospitals in 1963. Over time, having a funded GCRC became an indication of the level and quality of ongoing clinical research at any given institution. In the University of California health systems, all institutions with Schools of Medicine except UC Davis were either funded for a center or in one case (UC Irvine) had a satellite status.

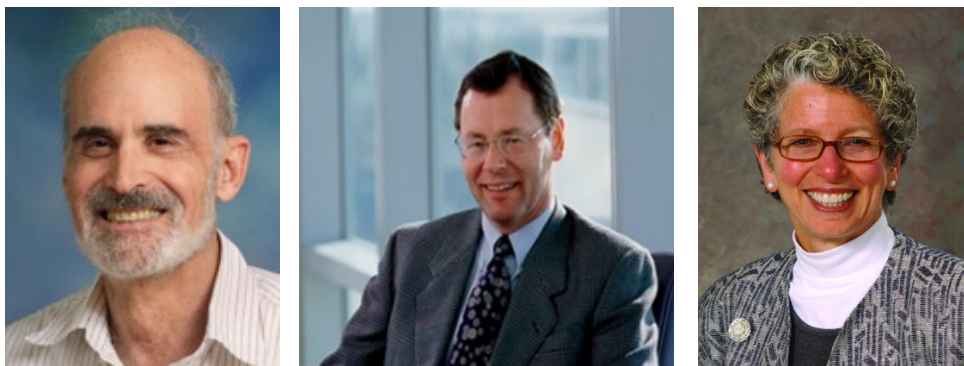
A. GCRC application

The lack of a GCRC facility at Davis was becoming an increasing element of concern given the increased focus on the many aspects of special services needed. The institutional leadership recognized this gap, and a number of factors were coalescing to provide momentum. While prior to the late 1990's the majority of funded medical research projects at UC Davis were done at preclinical sites on the Davis campus, the underpinnings for a clinical research program in Sacramento were getting stronger. The creation of a Cancer Center and the MIND Institute, both with important clinical research programs, contributed to this development as well as the increase of the clinical neurological footprint at the Sacramento medical center and the existence of a funded developmental Center for AIDS Research. All of these programs provided funded investigators who could serve as the core element of a GCRC application.



The UC Davis GCRC, established 2004 at the VA Northern California Health System hospital in Mather

Another obstacle - having a designated facility space - also got a solution, although somewhat unconventional. While no space could be identified at the medical center, UC Davis entered an understanding with the Northern California VA system that a designated GCRC space would be part of a planned new VA hospital at Mather. The need for a new VA hospital was due to the Loma Prieta earthquake in 1989 which had damaged the existing VA hospital at Martinez. The opportunity to build the new hospital at Mather opened when the Air Force medical facility at Mather was due for closure and taken over by the VA. While placing a GCRC at a VA facility was uncommon, it was not unheard of and in particular the GCRC facility in San Antonio, located at a VA, served as a valuable model. The effort for a joint UC Davis/VA program was enthusiastically supported by VA leaders including Drs. Brian O'Neill, David Siegel and George Kaysen, respectively chief of staff, chair of medicine and associate chief of staff for research. The latter served in a key role and was a long-term champion for a research facility at UC Davis. Finally, the recruitment of Dr. Berglund from Columbia University in early 2002 provided a solution for the future GCRC leadership. He served as the associate program director for the Columbia University GCRC and brought experience both from running a center and from a competitive renewal of the Columbia center.



The leadership team for the GCRC and CTSA applications, from left to right: George Kaysen, Lars Berglund and Jill Joseph

The initial goal for the GCRC project was to prepare a competitive application to the NIH that was closely aligned with the completion of the facility space at Mather. Immediately after arrival, Dr. Berglund assembled a small team and started to map out existing NIH resources at the institution that could be mobilized as part of the application. While the main focus was on School of Medicine resources, investigators conducting research projects with a patient focus were also identified in the Colleges of Engineering and Agriculture and Environmental Sciences. In particular, strong relationships were forged with the USDA Human Nutrition Research Center that recently had been relocated to Davis from San Francisco. A six-month mapping period allowed the identification of a sufficient number of patient-oriented funded studies as well a group of seven presenters who could serve as the core for a site visit. In parallel with this effort, contacts were established with NCCR staff who guided the preparation steps. In addition, the necessary resources for strong service components and leaders in biostatistics, bionutrition, laboratory, nursing, physiology and body composition, training and education and patient safety programs were established.

By the summer of 2003, the effort had matured, the hospital space was fully developed, and a formal GCRC application was submitted to NIH. Preparations were made for the site visit where the newly recruited executive associate dean, Claire Pomeroy, who was taking a leading role in the education component, brought significant institutional support to the effort. The site visit in November 2003 was successful and in spite of a challenging fiscal year for NCCR, UC Davis was formally awarded a GCRC in the fall of 2004 with Dr. Berglund as the first Program Director.

B. Transitioning from GCRC to CTSC

The first year of the GCRC award was focused on building key elements of the program and on supporting new clinical research initiatives. At the same time, two significant developments took place in the School of Medicine that further enhanced the clinical research footprint. An application for a K30 clinical research curriculum award under the leadership of Drs. Pomeroy and Meyers was successful, bringing an important training infrastructure to the institution (see below). The K30 program was designed as a master's degree program and received institutional degree-granting approval in 2005. At the same time, the School of Medicine launched a Clinical Research Investigator Services Program (CRISP), conceived to physically and administratively co-localize key resources to support clinical and translational research. The program was envisioned by Dr. Pomeroy and its development was further accelerated when she transitioned into the Dean position in early 2005. To take full advantage of CRISP resources, many of the traditional GCRC support service functions (e.g., Informatics, Biostatistics, Education) were co-located within the CRISP facility at the UC Davis Medical Center, approximately 10 miles from the Sacramento VA Medical Center, where the GCRC patient unit was located. This strategic decision was of key importance as the NIH launched the CTSA (Clinical and Translational Science Award) program in 2006. This program envisioned an enhanced clinical research service program, very much like the expanded CRISP resource, and compared to the GCRC program de-emphasized the physical in-patient resource.



The CTSC facility on the UC Davis Medical Center

Criteria for a CTSA award included a GCRC track record and a degree granting program, both achieved by UC Davis within the previous year. There were initially two options to transition from a GCRC to a CTSA – either a full application or apply for a planning award. Although recently funded as a GCRC, given the visionary CRISP facility and its integration with the GCRC, the GCRC leadership received encouragement from NCRR to submit a full CTSA application and this was also strongly supported by Dean Pomeroy and the institutional leadership. A comprehensive application was developed and submitted in the spring of 2006 with Dr. Berglund as leader together with Dr. Jill Joseph, who recently had joined UC Davis

from the National Children’s Center in Washington DC. The application was well received and scored in the top of all applications nationally. The same year, UC Davis was funded as one of the twelve inaugural CTSA programs in the nation. Of these, only three programs (UC Davis, UCSF and OHSU) were located in the western US (see figure below). A take home lesson was that the institutional support in establishing CRISP proved critical in building the framework to implement the CTSC.

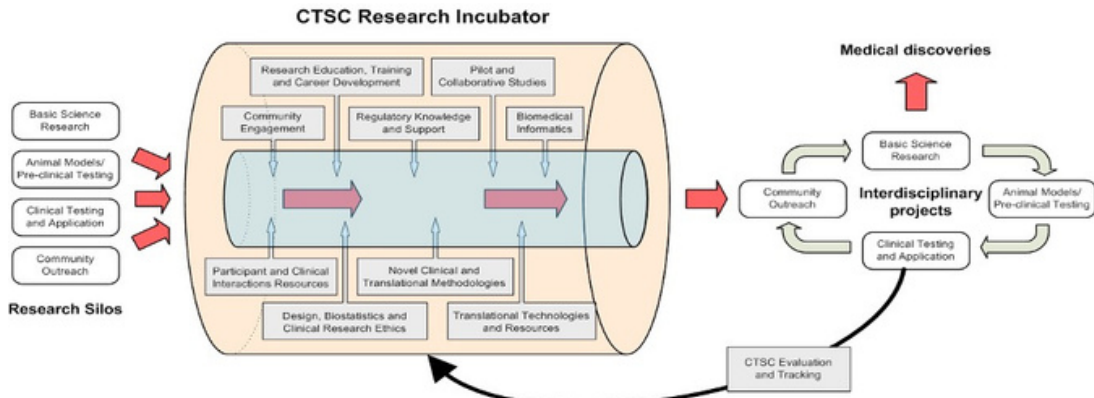
The funding of the UC Davis CTSC (Clinical and Translational Science Center) in 2006 brought major changes to the institution. As a member of the inaugural group, UC Davis was in the forefront of shaping the CTSA program at the national level and all the components quickly became engaged in working groups to establish overarching program goals. Importantly, the CTSA funding accelerated and further integrated an existing conscientious and careful planning effort for translational research with a stepwise approach to gradually increase institutional competencies, capabilities, and resources. It is noteworthy that the initial progress report for the first five-year funding cycle emphasized several transformations, the first being the evolution of the CTSC itself into a full-fledged service and training program. The second transformation represented the evolution of UC Davis and the key contributions of the CTSC to nucleate institutional programs in informatics, evaluation, a graduate education program for research trainees and an integrated clinical service and regulatory assistance program. The latter would over time develop into an institutional clinical trials office to support all aspects of clinical trials.

During the first funding period, a close and productive partnership emerged between the CTSC and the NIH-funded cancer center which was unique at the national level at the time. In hindsight, the UC Davis program



The inaugural 12 US CTSA centers (stars): OHSU, UCSF, UC Davis, UT Houston, Mayo Clinic, University of Pittsburgh, University of Pennsylvania, Duke University, Yale University, Columbia University, Rockefeller University, and the University of Rochester.

turned out to be an early indicator of the many productive partnerships at the institutional level that other CTSA programs reached at a later phase of their development. Finally, the UC Davis CTSC leaders assumed leadership positions at the national level and in this way helped to shape the early phase of the national CTSA consortium. This inclusive strategy proved to be a key decision as the institution could draw on many experiences and strategies at other CTSA sites and adapt these to a UC Davis setting.



The key principle of a research incubator that was ranked 6th in the US for the original CTSA application.

C. CTSC as an institutional resource

With this strong development in place, it was not surprising that the CTSC did well in the 2010 renewal application and was among the top scored programs nationally. The second five-year grant period was characterized by fully integrating the CTSC beyond the School of Medicine into the institutional research framework. Partnerships with the campus Office of Research and with key programs in Engineering and Veterinary Medicine were established as well as an organized interaction with the California National Primate Research Center. The CTSC leadership assumed key roles in the School of Medicine and campus research offices which served to broadly promote advancement of translational research initiatives. Both the school and the overall campus saw a continued increase in research funding during this time. Together with the other four University of California campuses with CTSA programs, UC Davis created the UC BRAID (University of California Biomedical Research Acceleration, Integration & Development) initiative that coherently brought all UC CTSA programs together. UC BRAID became a respected partner for all UC institutions as well as for the UC Office of the President and a trusted vehicle for innovative initiatives. The success of the BRAID initiative was rapidly copied in other areas of the country, further integrating CTSA programs nationally.

The CTSC was active in leveraging its programs and by the end of the funding period in 2016 had been awarded 18 supplemental NIH awards. Many of these were formative in extending CTSA efforts. Examples include the pioneering I-Corps award to establish a team-based entrepreneurial training program, use of social network analyses to establish collaborations, use of tele-technology to improve rural health management and a collaboration with the University of Washington to expand the cohort discovery tool. a resource that over time has been adopted by virtually all institutions.

The strong progress of the program resulted in a third successful renewal application in 2015 where UC Davis again was ranked among the top handful of programs nationally. By this time, the national CTSA program had evolved substantially and grant support for a clinical research unit was de-emphasized by NIH. This sparked reevaluation of the collaboration with the VA and resulted in the move of the clinical research support unit from Mather VA hospital to the medical center campus. At the same time, the unit transitioned into an outpatient service unit which better served the need of investigators given the national trend to decrease inpatient research studies. The third five-year grant period saw an increased emphasis on outreach and community partnerships and continued to expand the strong education and service foundation in place. The CTSC was leveraged in ensuring funding for an NIH Director’s program to expand research training for a broad spectrum of careers, which resulted in the FUTURE program led by Drs. Meyers and Berglund.



Frederick Meyers and Ted Wun

During the first funding period, a close and productive partnership emerged between the CTSC and the NIH-funded cancer center which was unique at the national level at the time. In hindsight, the UC Davis program turned out to be an early indicator of the many productive partnerships at the institutional level that other CTSA programs reached at a later phase of their development. Finally, the UC Davis CTSC leaders assumed leadership positions at the national level and in this way helped to shape the early phase of the national CTSA consortium. This inclusive strategy proved to be a key decision as the institution could draw on many experiences and strategies at other CTSA sites and adapt these to a UC Davis setting.

During this grant period, the CTSC leadership transitioned from Dr. Berglund to Dr. Wun, who had previously led several of the programs constituting the CTSC. Under his leadership, the use of digital health technologies to engage underserved urban and rural communities, cross-cutting community partnerships to advance health care access and community-based participatory research were important areas of focus as well as comprehensive data science training and continued resource support. This was facilitated by the CTSC being a key enabler in a comprehensive academic setting and resulted in a fourth successful grant application. Currently (2023), the CTSC has enjoyed 17 years of uninterrupted NIH funding, placing it in a very select group of institutions nationally.

Center for Regenerative Cures – Stem Cell Center



The Institute for Regenerative Cures

The UC Davis Stem Cell Program was initiated following the 2006 California referendum to establish a first-rate state Stem Cell research capability. This opportunity brought sufficient funds to establish a designated facility as well as to build a strong cadre of researchers. Strongly supported by the school leadership, a previously underutilized storage facility at the southern end of the Sacramento campus next to the CTSC was identified as an ideal center location and the

renovation started in 2006. From the start, it was envisioned that a Good Manufacturing Practices Facility (GMP) would be part of the program, and this effort was accelerated by the recruitment from Washington University of Dr. Jan Nolte as the overall program director and Gerhard Bauer as the GMP leader.

After a rapidly accelerating start, the program serves a central key function in the research portfolio and brings together physicians, research scientists, biomedical engineers and a range of other experts and collaborative partners. The facility is a hub for collaborative, team-oriented science that is advancing breakthrough discoveries designed to bring stem cell therapies and cures to patients everywhere.

The institute has established resources required for researchers need to take their projects from early stages to the successful submission of an Investigational New Drug (IND) application. The GMP facility has developed into one of the largest, most advanced academic Good Manufacturing Practice facilities in the nation, enabling researchers to safely process cellular and gene therapies for clinical trials. It also includes a disease-free vivarium with immune deficient and humanized mouse cores, as well as cores for vector production, karyotyping, stem cell culturing, mesenchymal stem cell expansion and transduction, teratoma assays, and quality control and quality assurance. Staff members, who include an experienced regulatory team, have extensive involvement in stem cell and gene therapy clinical trials. In addition, the institute is home to the California Umbilical Cord Blood Collection Program.

Building on this success and under the continuous leadership of Dr. Nolta, UC Davis currently has approximately 150 faculty members conducting stem cell-related research as part of more than a dozen different disease teams. Each of these teams is comprised of leading researchers and clinicians who are exploring the most promising approaches for advancing patient health. A balanced stem cell research portfolio, including both adult and pluripotent stem cell research, and a well-developed clinical trials resource through the alpha clinics allow UC Davis scientists to quickly adapt to new discoveries in this ever-changing field. Many current studies are aimed at comparing various types of stem cells to determine which are the safest and most effective. These scientists have developed nearly a dozen ongoing or recently completed stem cell and regenerative medicine clinical trials, with many more in the pipeline. Seven of its pending clinical trials – for peripheral artery disease, Huntington’s disease, osteoporosis, chronic wounds, spina bifida, dysphagia, and heart attack – are funded by the state’s stem cell agency.



Jan Nolta and Gerhard Bauer

The research focus on spina bifida, led by Dr. Diana Farmer, an internationally recognized leader in fetal surgery and chair of the Department of Surgery since 2012, has been very successful and has received a number of awards. Another success has been the development of gene therapy for Duchenne muscular dystrophy under the leadership of Dr. Craig McDonald, chair of the Department of Physical Medicine and Rehabilitation.



Diana Farmer and Craig McDonald

Alzheimer Disease Research Center

The Alzheimer Disease Center (ADC) received its initial NIH funding in 1991 and has been continuously supported by the NIH for more than 30 years. It was initially led by Drs. Robert Knight and William Jagust, both in the Department of Neurology. Following the departure of Dr. Jagust for UC Berkeley in 2004, the center has been continuously led by Dr. Charles DeCarli, from 2018 with Rachel Whitmer as co-Director. Under this leadership, the center has received multiple research grants and awards and emerged as a key UC Davis research center. The center has established satellite facilities in the San Francisco Bay area to ensure a strong recruitment base.



From left to right: Robert Knight, William Jagust and Charles DeCarli

The principal aim of the UC Davis ADC is to measure trajectories of cognitive change and transition to dementia among a carefully studied and highly diverse subject cohort in order to identify modifiable risk and protective factors with the ultimate goal to develop novel interventions to improve cognitive health and prevent dementia. This principal aim is accomplished through recruitment, maintenance and longitudinal

follow up of a cohort of subjects from both community and clinical referral sources that varies along the spectrum of cognitive ability, race/ethnicity, educational achievement, social economic status, spoken language and degrees of medical comorbidity. All UC Davis ADC participants are longitudinally followed and deeply phenotyped with extensive clinical, blood and imaging biomarker measures as well as developing state-of-the-art quantitative neuropathology. The ADC provides a robust research infrastructure, database management and a highly collaborative environment consisting of seven well integrated resource cores and one research education component. Overall, the program is designed to facilitate new research efforts and interventions, dissemination of research findings, education and training as well as encouraging researcher development.

To obtain these objectives, the overall specific aims of the UC Davis ADC are to: (1) Provide an environment and core resources to enhance cutting-edge research as well as encouraging extensive use of these resources by basic science, biomedical, behavioral, social and clinical investigators, (2) Manage these resources ethically, responsibly and efficiently through a well-established and highly effective administrative structure that seeks to foster new and innovative areas of research and treatments, (3) Provide investigators and research groups with a unique resource of well-characterized patients and control subjects through recruitment, retention and comprehensive assessment of a highly diverse cohort, (4) Provide a rich training environment for students, fellows and junior faculty to acquire research skills and experience in interdisciplinary aging and dementia research as well as mentor new and diverse faculty members, (5) Respond effectively to national needs related to AD and associated dementing disorders by timely submission of NACC reports, support of NACC data acquisition through MRI analyses and DNA submissions, (6) Educate individuals across the knowledge spectrum from medical professionals to the lay public and share new scientific information developed at the UCD ADC with NIA stakeholders, and (7) Support dementia advocacy in collaboration with the Alzheimer's Association at local, national and international levels, as well as supporting the NIA through service on various committees.

The UC Davis ADC directly supports multiple epidemiological studies of diverse communities to gain further insights into dementia risk reduction, early diagnosis, and the impact of various neuropathologies on aging and dementia. The efforts reflect the evolving needs of an increasingly older and more diverse US population. Moreover, while AD continues to be the major pathological cause of dementia, more recent studies—including one from the UC Davis ADC—find that dementia pathology is multifactorial and highly heterogeneous, due in part to the co-occurrence of AD and vascular disease, which varies by ethno-racial characteristics, is emphasized as part of dementia prediction and which can be modified by treatment even in later life. The center is uniquely qualified to support this research focus with a considerable impact on future AD/DRD diagnosis and treatment.

Center for Health and Technology



*From left to right: James Marcin,
Thomas Nesbitt and Ian Julie*

The Center for Health and Technology (CHT) was started in 1992 by Dr. Thomas Nesbitt, an early pioneer of establishing telemedicine as a comprehensive academic program. The center has developed into one of the strongest and most robust telehealth programs in the United States and it conducts a wide variety of clinical, educational, and research activities focused on improving people's health and well-being. The center



Center for Health and Technology, also housing the Center for Virtual Care

partners with community hospitals and clinics throughout California at more than 80 sites to provide residents and their physicians with access to specialized medical care and education through the use of telecommunications technology. This has contributed to solidifying the clinical reach of UC Davis throughout the region. The expertise of the center has been widely leveraged to serve community sites in Oregon, Nevada and Guam, facilitated the expansion of telehealth services to more than 200 sites, and developed the largest neonatal telehealth program in the country. Following the retirement of Dr. Nesbitt, the Center is led by Dr. James Marcin. The center provided regional leadership through creation of the California Telehealth Network and through this effort a central facility was created at the medical center that also houses a state-of-the-art virtual care facility, led by Dr. Ian Julie, for training and research purposes.



Session of the Mentored Clinical Research Training Program (previous K30)

Research Training Programs

In the early years after the foundation of the School of Medicine, there were few successful efforts to obtain funding for research training. One exception was a training grant in Comparative Lung Biology, led by Dr. Carroll Cross, that received NIH funding in the late 1970s. It was only after the institutional investments in center-based research programs and the subsequent growth of the research portfolio that broader efforts to develop training programs were made. A critical decision was to apply for a NIH K30 program in 2004, initiated by Executive Associate Dean Pomeroy.

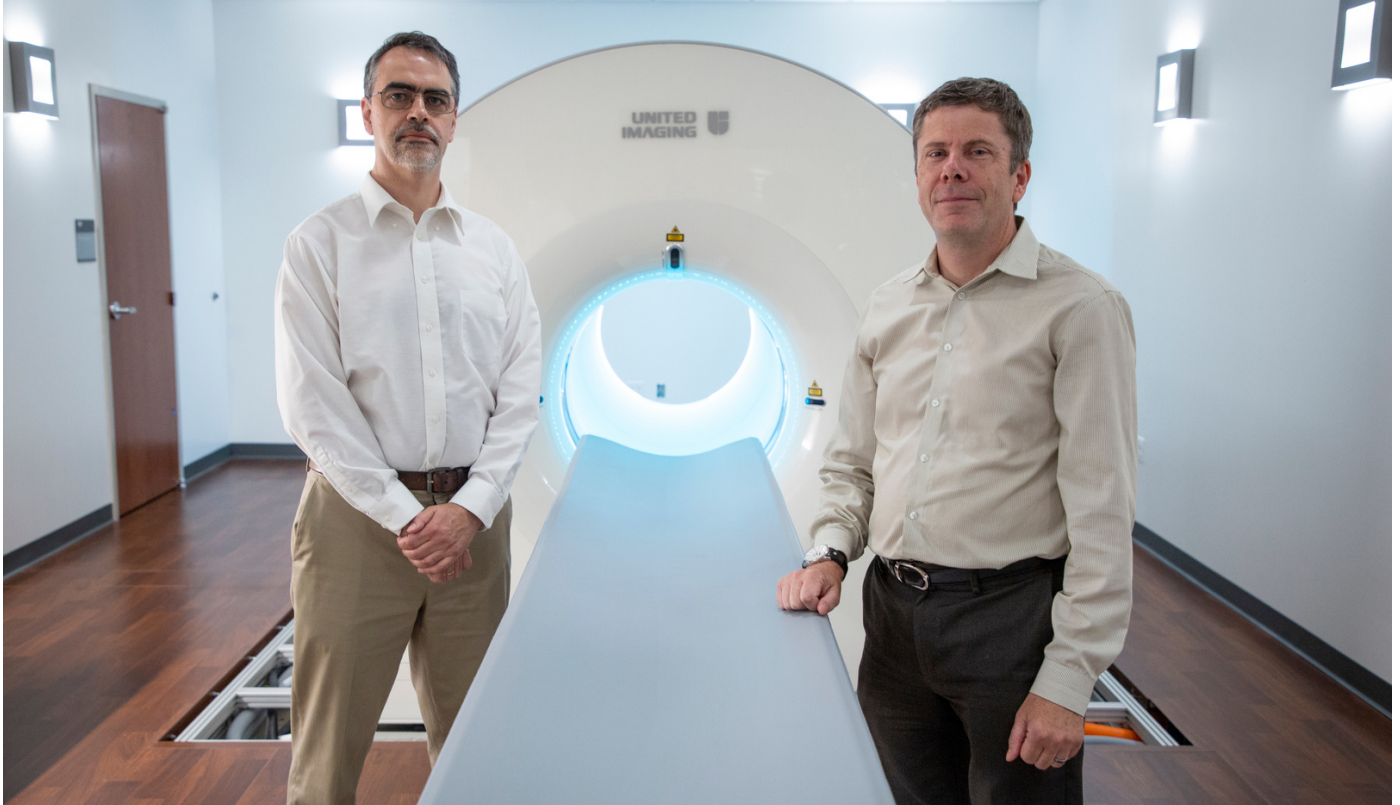
Under the leadership of Dr. Frederick Meyers, at the time chair of the Department of Medicine, a robust effort was made to engage department leaders, resulting in a successful application. As the CTSA program was initiated in 2005, the NIH mandated that the K30 programs would become part of the CTSA educational program and Dr. Meyers assumed the role as education director in the CTSC in 2006. The CTSC brought two additional training programs to UC Davis, a K12 program for junior investigators and a T32 program intended for predoctoral students. Together with the K30 program, rebranded as the Mentored Clinical Research Training Program (MCRTP), these programs constituted a critical mass and proved instrumental in bringing additional training programs to the institution. Several K12 programs followed – a K12 in Oncology as part of



From left to right: Nathan Kupperman, James Holmes and Carroll Cross

the Cancer Center led by Dr. Primo Lara, a K12 in Women's Health initiated by Dr. Pomeroy and later led by Drs. Nancy Lane and Ellen Gold, and a K12 in Emergency Medicine under the leadership of Drs. Nathan Kupperman and James Holmes. While some of these had a limited funding time, they collectively brought critical training and mentoring resources to UC Davis and established the importance to the institution of having a well-developed career path for junior faculty aspiring to a research career.

In addition to the K12 programs, a number of additional T32 and similar training programs were successfully funded over time in Pharmacology; Cardiovascular Medicine; Vision Science; Musculoskeletal Health; Quality, Safety and Comparative Effectiveness and several programs focused on Neurological Sciences (Autism, Neurotherapeutics, Cognitive aging, Communication science, and Neuroscience). In 2013, UC Davis was one of 10 institutions to receive NIH funding to establish a program that sought to establish a broader career path beyond faculty positions for doctoral students: the FUTURE program, led by Drs. Meyers and Berglund. The program was integrated with the university-wide Office of Graduate Studies and was later an important contributor to establish the Lifelong Learning program at Aggie Square.

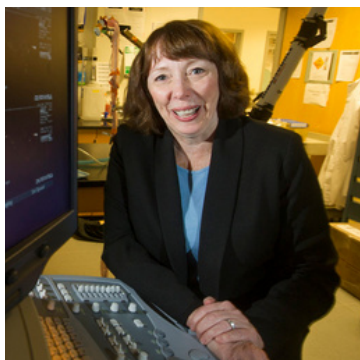


Simon Cherry (right) and Ramsay Badawi pose with EXPLORER, the first whole-body PET scanner in the world.

Research Partnerships - Biomedical Engineering

The College of Engineering was founded in 1962 built upon the core strength of agricultural engineering and subsequently expanded to encompass a wide range of engineering disciplines. In the 1970's and 1980's, programs were established in computer science and aeronautical engineering. Over time, strengths in energy, climate, transportation, biomedicine and space exploration emerged. Although there was no designated Biomedical Engineering department at the time, a graduate group focused on this area was established as early as 1970. In the early years of the graduate group, the primary research emphasis was in Musculoskeletal Biomechanics. To create a Division of Biomedical Engineering and expand the research emphasis of the graduate group, a Whitaker Foundation Special Opportunity Award was pursued. Along with the contribution of matching funds from the College of Engineering, this Special Opportunity Award (awarded in 1999) formally established a Division of Biomedical Engineering within the college allowing the addition of research tracks in Imaging and Molecular & Cellular Engineering.

In 2001, with broad university support including the School of Medicine through Associate Dean Dr. Roy Curry, the division of Biomedical Engineering received a substantial leadership development award from the Whitaker Foundation, which provided start-up funds for new faculty and helped fund the construction of the Genome and Biomedical Science Facility. Soon after, the Division of Biomedical Engineering was converted to the Department of Biomedical Engineering (BME), initiating a long history of collaboration with the School of Medicine as illustrated by the cases below. The founding chair was Dr Kathleen Ferrara and key new faculty included Drs. Simon Cherry and Julie Sutcliffe. Subsequent chairs have been Drs. Michael Savageau, Kyriakos Athanasiou, Alyssa Panich and Steven George. Below, we provide three examples where faculty members in Biomedical Engineering have partnered with School of Medicine faculty to develop key research projects.



*From left to right:
Katherine Ferrara,
Julie Sutcliffe and
Simon Cherry*

Example 1: Breath Analysis and Lung Disease

In 2006 a CTSC pilot study focused on new asthma treatment regimens (L-Arginine Therapy in Asthma), led by Dr. Nicholas Kenyon, was funded. He was rapidly approached by Dr. Cristina Davis, a colleague in the Department of Mechanical and Aerospace Engineering, who had an interest in the evaluation of exhaled breath. They teamed up in a project focused on Detection of Novel Biomarkers of Asthma and COPD in



Cristina Davis and Nicholas Kenyon

Exhaled that included 5 trainees and resulted in 29 presentations, 16 publications, and 4 book chapters. The project furthered the use and design of portable microscale sensor systems for mobile breath analysis diagnostics, an early use of portable sensors. This technology has been applied more recently to studies on COVID-19, opioids, as well as wildfire smoke exposure. A strong research program on breath analysis is now in place and has generated exceptional extramural funding from the NIH, Hartwell Foundation, Office of Naval Research, and the Air Force, to name a few. Notably,

many of the trainees that participated in the program have over time developed their own research programs and received extramural funding, ensuring a pipeline of translational investigators and continuation of the research project concepts in new directions.

Example 2: Biomedical Imaging

In 2007, Dr. Ramsey Badawi, a faculty member in the Department of Radiology, was awarded CTSC funding for a project entitled “3D Molecular, Functional, and Anatomic Imaging of Therapeutic Response in Rheumatoid Arthritis.” The team led by Dr. Badawi developed a novel method for automatic corrections for gain changes in positron emission tomography (PET) detectors, computed tomography (CT), and Magnetic Resonance Imaging (MRI). The project resulted in 12 presentations and several publications and led to the creation of a Molecular Imaging in Rheumatology program led by Dr. Abhijit Chaudhari, at that time a postdoctoral fellow in the team. After receiving a faculty appointment, Dr. Chaudhari has been appointed as Director of the Center for Molecular and Genomic Imaging. In subsequent grant applications in partnership with Dr. Simon Cherry, Department of Biomedical Engineering, Dr. Badawi leveraged the pilot project results for additional technology developments that ultimately led to the development of an innovative total-body PET scanner, EXPLORER, through the funding of an NIH Transformative R01. This innovative technology provides a means to image all tissues and organs in the body at the same time and provides an effective sensitivity gain of at least a factor of 40 over current conventional PET scanners. This sensitivity gain can be used to acquire 40-fold more signal (a >6-fold increase in signal-to-noise), or to acquire total-body images in 1/40th of the time or at 1/40th of the radiation dose. This methodology profoundly transforms the application of PET in clinical diagnostics and research, and through NIH funding is now in clinical use at UC Davis Health.

Example 3: Photonics and Biomedical Engineering

In 2007 Dr. Laura Marcu, a faculty member in the Department of Biomedical Engineering, received CTSC pilot support for clinical intraoperative evaluation of a fluorescence lifetime-based technique for demarcation of head and neck tumors. In addition to refining the technique with improved diagnostic capability, the combination of spectral and time-domain derived fluorescence parameters allowed for the discrimination of normal tissue versus pathology. The experiences of combining detection techniques led to subsequent studies to develop a multimodal imaging catheter for diagnosis of atherosclerotic cardiovascular diseases involving both optical and ultrasound techniques. Together these studies resulted in several funded NIH grants and the establishment of a long-term collaboration between faculty in engineering and medicine to advance multimodal imaging in several clinical areas. These partnerships have also resulted in methods to guide robotic surgery in real-time as well as to enhance cancer detection in resected tissues.



Laura Marcu

Together with Dr. Cherry, Dr. Marcu assumed leadership of the Biomedical Technology program of the UC Davis Cancer Center, a program that consistently has received high marks in grant reviews. Building on this foundation and in partnership with Dr. Griffith Harsh, chair of the Department of Neurosurgery in the School of Medicine, Dr. Marcu received NIH funding in 2022 for a National Center for Interventional Biophotonic Technologies. Further, through a partnership between Dr. Marcu and the School of Medicine, the UC Davis component of an NHLBI-funded initiative to advance entrepreneurship relevant to the institute's mission, the University of California-wide Center for Accelerated Innovation, was established. This brought attention to the area of innovation and was a critical component in galvanizing institutional support for the NCATS I-Corps program, locally led by Drs. Kenyon and Davis (see Example 1).

Research Administration and Funding

The administrative underpinning for the research portfolio in the School of Medicine resided first in an Office of Sponsored Programs and later in a more comprehensive Office of Research. The Office of Sponsored Programs was established in 1969 under the leadership of Binning Chambers. Mr. Chambers was a retired Major in the US Air Force and was appointed to lead the office as the Research Project Administrator. After establishment of the office, all faculty grants from public and private entities were processed and recorded in the office. In 1974, after 5 years of activity, Dean Tupper presented the first research report for the School of Medicine with a grant portfolio of \$12 million with 86 Principal Investigators.

As the research activity and the associate grant portfolio of the School of Medicine expanded, it became clear that an updated system for tracking and analyzing grants and contract data was needed. The Radio Shack TRS 1000 system used in the early 1980's no longer met the needs of the School of Medicine. This was resolved by the contribution of Dr. Paul Davis, a researcher in the Division of Pulmonary Medicine in the Department of Medicine, who created a grant information module using the FileMaker application on a Macintosh computer. The system allowed an in-depth analysis of the research enterprise and remained the primary tool for an internal reporting system for the next 30 years.

In 1981, as Dr. Hibbard Williams had been appointed as the second dean of the School of Medicine, the school's grant and contract portfolio had reached \$40 million with 100 active grants and contracts. In view of this increase, the administration was strengthened and Dr. Ted Wandzilak, who previously worked in the laboratory of Dr. Williams, assumed the position as director of the Office of Sponsored Programs, a position he would hold for more than 30 years. To enhance the capacity of the office, Dr. Wandzilak hired Gail Dotson as administrative supervisor, creating an efficient and durable partnership lasting 25 years. He also worked closely with Karen Eilers, the executive administrative leader in the dean's office, who was very supportive and encouraging of the research program. Due to these frequent interactions, it was ensured that the research program remained an area of focus for the school leadership.

As research activities grew, the office was tasked with additional responsibilities for laboratory safety, medical receiving and the oversight of several health sciences service laboratories including special instrumentation, protein structure and animal survival surgery. The latter proved to be an important regional resource, serving Bay Area institutions as well as UC Davis faculty.

The appointment of Dean Lazarus in 1993 brought important changes. He appointed Dr. Roy Curry as the first associate dean for research in the School of Medicine; Curry recruited Dr. Don Martensen to establish an office of research. Dr. Martensen remained a key resource for the office for close to 20 years with oversight of internal and external communications. The Office of Research worked closely with the established Office of Sponsored Programs and over time the boundaries between these offices became increasingly fuzzy, as they together became the primary focal point for all research related programs, including grants and contracts, space allocations, bridging support and intramural funding opportunities, such as the Health System Research Awards. Consistently during this time and going forward, the School of Medicine Research offices maintained a highly collaborative and collegial relationship with the UC Davis Office of Research, in particular with the associate vice chancellors for research administration (Drs. Lynne Chronister and Cindy Kiel) and the long-term director of the UC Davis Sponsored Program Office, Dr. Ahmad Hakim-Elahi. While some functions, such as clinical trials contracts, were initially handled by the UC Davis Office of Research, over time they were delegated to the School of Medicine Office of Research as the school's contract portfolio continued to expand.



From left to right: Ted Wandzilak, Mark Romney, Anuurad Erdembileg and Don Martensen

Due to the growth of the research program and the increasing demand for space, the office worked closely with Mark Romney from the Facilities Design & Construction office. He served as the lead from the School of Medicine for the planning and construction of GBSF and for the renovation projects of Tupper Hall. Over time, he became the primary contact for faculty regarding space issues. As space remained a critical resource its allocation was constantly in focus. Under Dr. Curry’s leadership, a space allocation formula was developed, taking funding as well as the number of funded personnel into account. This remained a main guiding tool for many years. Given the close working relationship with the SOM, Mr. Romney was formally hired by the Office of Research. In the 2010s he played a critical role in the planning for the expansion of the research space at the Medical Center, a project that grew into the Aggie Square development as Chancellor May was appointed.

In 2008, following the retirement of Dr. Curry, it became clear that a consolidation of the Offices of Sponsored Programs and Research would be a logical next step. At that time, the office expanded with the addition of a Grants Facilitation unit, originally modeled on the Interdisciplinary Research Support office on the UC Davis campus. Initially, Erica Chédin was hired to initiate the activities followed by the recruitment of Jeffrey Elias from NIH and Betty Guo. This office would play critical roles in assisting large center and training grant applications as well as helping junior investigators making their initial applications competitive. Overall, as outlined below, the Grant and Contracts portfolio grew significantly from 2005 forwards. For some of these years, UC Davis School of Medicine had one of the highest growth rates in NIH funding nationally as judged from AAMC data.

As Dr. Wandzilak retired in 2016 and was succeeded by Dr. Anuurad Erdembileg, who had been a trainee in Dr. Berglund’s laboratory, it became clear that the Office of Research needed to partner closely with the UC Davis Office of Research and leverage the grant reporting tools in the office. Under Dr. Erdembileg’s leadership, the office has adopted state-of-the-art reporting and analytical tools and the annual research report formats have been copied widely by other institutions. The current (2023) leadership and staff of the office is shown in the picture below.



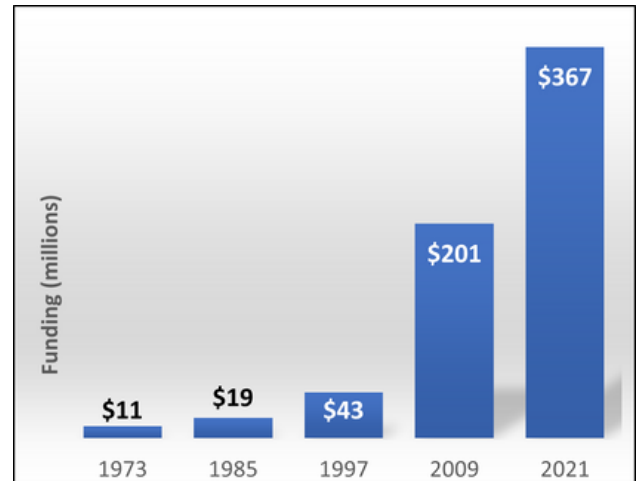
The current (2023) leadership and staff of the School of Medicine Office of Research including Vice Dean Kim Barrett (left front).

Research funding overview

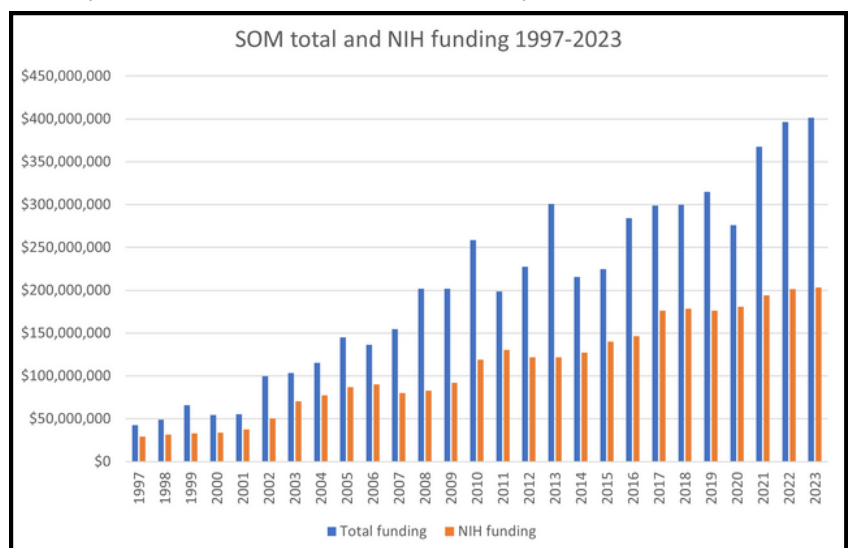
Over its 50-year history, the research funding for the School of Medicine has increased from a humble beginning to reach a level placing the school in the top quarter of US medical schools. As mentioned above, in 1974, already 6 years after the start of the school, Dean Tupper presented the first research report, detailing a funding level of \$12 million. From 1975 to 1985 the annual extramural funding increased to \$19 million, largely due to growth of research on the Davis campus. By 1990, the funding level had increased to \$40 million, driven mainly by increased research in clinical departments, particularly due to recruitment of basic science faculty in these departments, as described above. These recruitments strengthened research programs in cancer, bone and tissue repair, infectious disease, and psychiatry/neurology.

In 1992, at the end of the tenure of Dean Hibbard Williams, 81 faculty held NIH funding. Areas of strength included cardiovascular research (Longhurst, Bonham, Amsterdam, Rutledge, Segel, O'Donnell, Curry, Renkin, Gray, Green, Kaufmann); infectious disease (Gardner, Chuang, Beaman, Last, Luciw, Chang, Dandekar); and Neuroscience (Gazanniga, Agius, Jagust, Knight, Richmond). Setting the stage for research growth in Sacramento, several research buildings were opened in Sacramento in 1992.

Data for funding levels during the early period for the School of Medicine are relatively sparse and much of the information resides in formats that are challenging to access. As of 1997, data for total research funding as well as specifically NIH funding is consistently available. In the graph above, we present the funding numbers post-1997 for the same time intervals (12 years) as were available prior to 1997 to convey a picture of growth during periods of consistent length. As can be seen more clearly in the figure, research funding accelerated at an unprecedented rate in the decade following 1997. Thus, as the research funding for the School of Medicine broke the \$50 million mark shortly after 1997, it quickly increased to over \$100 million in 2003 to again be doubled to \$200 million in 2009. Notably, this coincided with the two impactful strategic plans that laid out specific plans for recruitments, investments and infrastructure development.



Building on this strong foundation, research activity has continued to increase in the years after 2009, for the first time reaching a level above \$400 million in 2023, representing a close to 10-fold increase over a 30-year period. As can be noted in the graph (right), the rate of increase has been relatively even, indicating that it is sustained by a diverse research portfolio and not dominated by a few large grants, likely more susceptible to one-off funding decisions. In parallel, the national ranking of the school with regard to NIH funding has steadily improved from being ranked below 60 to being among the top 30 institutions already by 2015. It has since remained ranked in the interval between 26-36, within the top quarter of all US medical schools.



Concluding Remarks

As we, Roy Curry, Ted Wandzilak and Lars Berglund, collectively responsible for the leadership of the School of Medicine Office of Research for a close to 30-year period, from 1992 – 2020, have taken on the task to document the history of the School of Medicine research program, we recognize that the report is far from complete. We decided at an early stage that it would be important to document how decisions were made regarding the overall direction of the school and the interaction with the hospital would impact on the future of the research program. Therefore, we have included a summary of the development of the school at large to document the environment where the nascent research program began to accelerate to reach the top quarter of schools of medicine nationally today. We also recognize that many research contributions and advances are not detailed in the report. We do not intend to diminish any contributions by faculty to the research program, but it seems to us that a more detailed history might be better suited for departmental reports. Further, we have not covered the education or clinical missions apart from any direct implications for the research mission.

Overall, we feel privileged to have experienced the development and growth of the School of Medicine research program. At the time of the inception of the school in the 1960's, the intention of the state government and the UC system were primarily to establish a first-class education program for family medicine physicians to satisfy the growing medical need of the rural regions of the state. These fundamental goals still ring true as the medical student body is highly diverse and many of the graduates become primary care physicians and practice in California. However, we have also witnessed the transformation of the school to a nationally and internationally recognized academic health center with a research program that ranks at the top of the nation. As our nation, and indeed the world, faces many daunting challenges, of which some could be existential, the School of Medicine faculty have much to offer. UC Davis provides a test bed for academia to respond to these challenges by offering the full integration of disciplines, such as agriculture, environmental science, engineering, physical science and basic biology with the full spectrum of health science from animals to humans. The path taken so far is a hopeful indication, and we firmly believe that the many examples of interdisciplinary and inter-college or inter-school research programs to date provide a solid ground to expand on.

We have also come to deeply appreciate the often-heroic efforts by faculty in growing research programs under challenging conditions and we have a deep respect for the trailblazers who paved the way for the nationally prominent research program of today. We hope that many of them have been able to see what their efforts have produced and to appreciate the strong training environment that has been created and that will benefit future generations.

Throughout this report, it has been apparent to us that the most critical and far-reaching decisions impacting research were made when the hospital and school leadership were able to reach consensus and when both saw research advances as an important tool to advance the health system at large. Examples of such tipping points are the strategic plans of the 1990s and 2004, when the synergy achieved resulted in visionary plans and recruitment of key research leaders. Both those plans resulted in periods of major growth in research funding. These decisions still affect ongoing research. Further, the close relationship between the school and the university leadership that has been in place for a long time has contributed to optimizing resources. Today, as the Aggie Square project, located at the medical center, is taking shape as a top UC Davis priority, the opportunity is there to reach similar visionary decisions that might reverberate for decades. Aggie Square represents one of the most ambitious projects in the history of UC Davis and the School of Medicine has from the start of the planning been a major stakeholder. Beyond serving as a meeting ground for community, industry and academia, it represents a catalytic opportunity for team-based interdisciplinary research bringing

key UC Davis strengths together. Without doubt, the resources under way will shape research directions for the foreseeable future and we look forward to seeing this development being captured as part of a future historical documentation.

We also note that, initially, most of the funded research was based on individual laboratories. The relative fraction of research funding based on R01 grants was for a long time higher at UC Davis than at any other UC School of Medicine. Over time, these research capabilities have served to form a basis for several center grants, and in turn these awards have led to larger program projects and training grants. The path can in a simplified way be summarized as follows:



We realize that this simple graph does not capture the complexity of the development of the School of Medicine research program over its 50-year history, but we feel that it does symbolize the general direction towards team science and having long-term NIH-funded research centers as important anchors. As medical research is reaching tipping points regarding novel areas such as data science, artificial intelligence and entrepreneurship, the scheme above might be modified. However, we suspect that the general path from individual efforts generating larger team advances followed by training and large, focused projects might still apply.

In closing, we hope that the story we have told will be of interest even to a new generation of researchers. An old saying states that there is nothing that predicts the future so well as the past. While this may be true of individuals, it may well apply to institutions as well. If so, we believe that the UC Davis School of Medicine can look forward with confidence to an exciting and innovative future for its research program.

Davis, October 30, 2023

Fitz-Roy Curry, Ph.D.

Theodore Wandzilak, Ph.D.

Lars Berglund, M.D., Ph.D.

Appendices

APPENDIX 1

School of Medicine faculty, current and previous, Nobel Prize winners, members of the National Academy of Medicine, Science and Innovators and AAAS Fellows:

Nobel Prize:

Edwin Krebs, Nobel Prize in Medicine and Physiology, 1992

National Academy of Medicine:

David Amaral
Diana Farmer
Julie Freischlag
Michael Gazzaniga
MRC Greenwood
Kenneth Kizer
Nathan Kupperman
Nancy Lane
George Lundberg
John Morrison
Claire Pomeroy
Paul Sieving
Judith Stern
Phyllis Wise

National Academy of Science:

Andreas Baumler
Michael Gazzaniga
Ted Jones

National Academy of Inventors:

Nancy Lane
Hari Reddi
Michael Rogawski
Justin Siegel

American Academy for the Advancement of Science Fellows:

David Amaral
Peter Barry
Lars Berglund
Robert Berman
Donald Bers
Satya Dandekar
Jonathan Eisen
David Fyhrie
Eric Gershwin
Johannes Hell
Nancy Lane
Michael Leibowitz
Paul Luciw
Frederick Meyers
Jan Nolte
David Rocke
Michael Rogawski

APPENDIX 2

Deans, Executive Associate Deans and Associate and Vice Deans of Research, School of Medicine:

Deans:

C. John Tupper	1966-1979
Morton Levitt (Acting Dean)	1979-1980
Ernest Gold (Acting Dean)	1980
Hibbard Williams	1980-1992
Gerard Lazarus	1993-1997
Joseph Silva	1997-2005
Claire Pomeroy	2005-2013
Thomas Nesbitt (Interim Dean)	2013-2014
Julie Freischlag	2014-2017
Lars Berglund (Interim Dean)	2017-2019
Allison Brashear	2019-2021
Susan Murin (Interim Dean)	2021-

UC Davis Vice Chancellors for Research:

Larry Vanderhoef (interim)	1989-1990
Robert Shelton	1990-1996
Kevin Smith	1997-2001
Barry Klein	2001-2010
Harris Lewin	2011-2016
Cameron Carter (interim)	2016-2018
Prasant Mohapatra	2018-2023

UC Davis Deans for Graduate Studies and Research:

Byron Houston	1961-1967
Harold Reiber	1967-1969
Allen Marr	1969-1989

Executive Associate Deans:

Earl Wolfman	1966-1980
Ernest Gold	1980-1989
James Castles	1989-1998
Thomas Anders	1998-2002
Claire Pomeroy	2002-2005
Thomas Nesbitt	2005-2017 (Administration and Clinical Outreach)
Ann Bonham	2005-2008 (Academic Affairs)
Frederick Meyers	2008-2016 (Academic Affairs)
Primo Lara	2018- (Cancer Programs)

Research Deans:

Roy Curry, Associate Dean	1995-2008
Lars Berglund, Assistant Dean	2005-2006 (Clinical Research)
Lars Berglund, Associate Dean	2006-2008 (Clinical and Translational Research)
Lars Berglund, Sr Associate Dean	2008-2016
Lars Berglund, Vice Dean	2016-2020
Kim Barrett, Vice Dean	2021-
Ted Wun, Associate Dean	2012-
Angela Haczku, Associate Dean	2017-2023
Ralph deVere White, Associate Dean	2010-2016 (Cancer Programs)
Ted Wandzilak, Assistant Dean	2014-2016
Anuurad Erdembileg, Assistant Dean	2016-
Rachael Callcut, Associate Dean	2023-
Melissa Bauman, Associate Dean	2023-

