The Center for Precision Medicine
A Whitepaper for the Campaign Steering Committee

THE VISION

Few advances in medical science have sparked as much excitement and hope as precision medicine. From cancer immunotherapy treatments to fitness wearables, precision medicine is in the headlines and on the leading edge of translational research efforts. UC Davis is already the global leader in comparative immunobiology, to take just one example of our interdisciplinary breakthroughs in precision medicine—but we want to do more. Expanding precision medicine’s current scope, we are amplifying our work to advance personalized cures for individuals while supporting global wellness through addressing health disparities.

This is a watershed moment, one in which the university is poised not only to realize the tremendous promise of precision medicine but also to define a broader, bolder paradigm that holds the potential to touch every life. UC Davis has a vision to drive innovation at the interface of precision medicine, population health and environmental health. We have a time-sensitive, game-changing opportunity to transform contemporary understanding of how individual and population health are shaped by biology over the lifespan, lifestyles and behaviors, and environmental factors from air quality to socioeconomics. Inspired by precision medicine’s potential, UC Davis seeks to seize this extraordinary opportunity to improve wellness and care across our region and on a national and global level.

The Center for Precision Medicine will unite UC Davis’ breadth of expertise to make individual and population health more predictive, preventative, personalized and participatory—empowering individuals and communities as partners in their own wellness and training the next generation of data-fluent health professionals. Leveraging the powerful resources and proven collaborations among our comprehensive health system, interdisciplinary data sciences and renowned environmental leadership, we are poised not only to rapidly translate research from bench to bedside and back again, but also to scale it up to the population level. Building upon the premise that our genetic code and zip code are equally informative, this uniquely comprehensive paradigm will transform individual, community and global health.

Recognizing that the emerging wealth of new tools and approaches—from the full spectrum of “omics” to mobile health technologies to patient-centric engagement research—are the means to achieve progress faster, UC Davis is well positioned to unlock the full potential of this toolkit. In partnership with the university’s peerless constellation of thought leaders spanning the disciplines from medicine, nursing, veterinary medicine, bioengineering, computer science and public health, the Center for Precision Medicine (CPM) will create new agile dream teams that will accelerate breakthroughs in health, wellness and healthcare delivery at all scales. And every step of the way, undergraduate, graduate and professional students will have hands-on opportunities to develop cutting-edge skills, learn how to solve previously unapproachable challenges, and engage patients and populations meaningfully.

The CPM will have a concrete impact on equitable healthcare access and individual informed choices in Northern California by collaborating with the College of Letters and Science, the School of Medicine, the Betty Irene Moore School of Nursing and the Graduate School of Management in developing effective health communication and informing public policy. In doing so, we will create a new platinum standard for how a premier academic health system can evolve into a continuous learning system and, in partnership with its neighbors, uplift a whole region.

The Center for Precision Medicine will be the place where a healthy future for all is secured.
THE RIGHT TIME AND THE RIGHT PLACE

Since President Obama’s 2015 State of the Union address and subsequent Precision Medicine Initiative, there has been a veritable gold rush of institutions and private companies seeking to develop new patient therapies and techniques, and to integrate public and private data.

Yet despite significant investment and public enthusiasm, industry typically does not have access to health systems or broad, diverse patient populations that support validation and sustained engagement at scale. Academic health systems rarely have the depth of computational and analytic skills to establish centers dedicated to precision research. And there is considerable competition with industry and across academia to recruit skilled individuals—there are very few individuals with expertise in both data science and a health-relevant discipline, and those who do possess this unique skillset are often recruited by some of the world’s largest consumer companies with the promise of substantial infrastructure resources.

In this pivotal moment, with so many powerful players across the public and private sectors moving forward, UC Davis stands out from the field in three important ways:

*Unmatched breadth of research assets*

Home to the world’s number one School of Veterinary Medicine, an internationally renowned College of Agricultural and Environmental Sciences, one of only seven Primate Research Centers in the nation, a top-ranked health system comprising a NCI-designated Comprehensive Cancer Center and a Level I trauma center, lauded medical and nursing schools, and a world-class College of Engineering—with strengths in relevant fields from nutrition to economics to ethics—UC Davis is ideally positioned to be a global leader in precision medicine. No other public research institution holds a comparable suite of high-caliber competitive advantages, nor is able to foster the types of linkages that are already underway at UC Davis.

Another critical component of precision medicine is incorporation of the individual’s immune status, which is even more unique than their genetics as it changes when we age and are exposed to pathogens. UC Davis is perhaps one of the only institutions capable of doing comparative immune studies (such as vaccine responses, or cancer treatments) using multiple species including mouse, dog, non-human primate and human in order to provide a more complete picture. Furthermore, the examination of companion animals provides unique insights with regard to environmental effects and exposure on the individual.

Additionally, UC Davis Health System maintains data on over 2.2 million highly diverse patients, representing inland California from north of Los Angeles to the Oregon border and east to Reno, and is one of the five academic medical centers in the University of California system with a population of over 14 million patients. Unique to UC Davis, our proximity to the State Capitol has fostered extensive collaborations with the California Department of Public Health. The CPM will capitalize on all of our resources and capabilities to bring a truly unique, forward-looking and comprehensive perspective to the table.

*Commitment to data science training for all students*

Recognizing that the practice of medicine is rapidly transitioning from a data-poor to a data-driven domain, the CPM will stimulate a culture of data-fluent nurses and physicians, health advocates, policymakers and engineers. In partnership with the College of Engineering and the interdisciplinary Data Science Initiative, the CPM will develop a highly skilled pipeline.
From introductory biomedical informatics seminars for freshmen to data mining bootcamps for graduate students to specialized research opportunities for postdoctoral scholars, the CPM will ensure that every student—regardless of his or her discipline or professional aspirations—leaves UC Davis with critical perspectives on gaining meaning from vast amounts of data, the creative thinking skills to select and apply data tools in new and transformational ways, and the collaboration skills to effect analytics-informed change across traditional boundaries.

**Public service ethos**

Currently, precision medicine offers the potential of personalized cures for the few who can afford treatments or enroll in selective clinical trials. Rooted in UC Davis’ long legacy of public service and aligned with the university’s vision for the 21st century, the CPM has a simple but bold and egalitarian goal: effective, accurate, and accessible care for all. Just as our faculty position us for breakthroughs in new knowledge, our ethos positions us to shine a light on how healthcare systems can embrace inclusion and equity, working with patients and communities as full and equal partners in applying research for the public good. Not to be overlooked is the role we play as advisors to governmental and non-governmental agencies; advocacy and policy is a critical domain of precision medicine.

UC Davis is the only university in the nation with the tools, people and vision necessary to take precision medicine where it needs to go for the greatest benefit.

**THE OPPORTUNITY**

Imagine a newborn whose pediatrician can predict a serious lung defect—and tailor a targeted treatment before the baby takes his first breath. Or a retiree whose smartwatch monitors her hypertension therapy, pinpointing the optimal medication for her personal genomics and enabling her to eliminate unnecessary medications. Imagine, too, a neighborhood that drives policy changes benefiting millions by working with UC Davis researchers to provide personal and environmental data linking its disproportionately high cancer rate with local pesticide use. Potential interventions like these are just a few examples of how UC Davis’ uniquely comprehensive precision medicine approach could touch every life.

At the core of the CPM’s work will be understanding individual and population variation and relating the two. This will require actively forming new teams of faculty and students that use new tools and new data sources. These teams will also have members from the private sector and patient and community representation. These new teams will drive innovation in both basic sciences as well as science in the interest of society. Examples of the range of research and training domains that these new faculty will lead include:

- New teams among the School of Medicine, the Betty Irene Moore School of Nursing, the School of Veterinary Medicine and the College of Biological Sciences to promote innovations in human genetics, healthcare quality, value, patient experience and public health.
- Environmental sensor data integration and modeling of population outcomes of patients with chronic disease, such as physiological monitoring sensors for rural asthma patients.
- New linkages between the College of Engineering and the graduate programs in epidemiology, public health, biostatistics, health informatics, nursing and health leadership to teach domain-focused data analytics and research to undergraduate and graduate cohorts.
- Leveraging the UC Davis One Health Initiative—which works at the interface of animals, people and the environment to solve complex health problems—to apply precision medicine to emergent crises like Zika virus.
The CPM will focus on four major strategies for aligning and recruiting the scientific, clinical and social expertise, technological and infrastructure resources, and innovative capabilities necessary to move the needle on high-impact precision medicine.

**Actively engage persons as partners, not merely patients**
This strategy will work actively to recruit and enroll individuals from all populations, demographics, and disparities, from all ages and stages of life, from all genders and lifestyles, and from all levels of health and wellness. Empowering participants to become actively engaged as partners in their healthcare decisions and choices will ensure the sustainability of their participation over a lifetime. Additionally, this strategy will solidify the CPM’s leadership role in establishing best practices for informed consent, health advocacy, patient rights and protection, and particularly individual privacy in the era of Big Data.

**Integrate multiple omics platforms with health informatics to inform analysis and interpretation**
This strategy will seek to apply and adapt a diversity of analytical platforms, including genomics, proteomics, metabolomics, transcriptomics, epigenomics and microbiomics to the identification and monitoring of individual-specific biomarkers of disease, disease risk and propensity, and disease protection and prevention. We will also develop novel ways to gather (e.g., mobile health technologies), hold (e.g., biobanks, databanks), and transform (e.g., health informatics) the vast sea of raw data into actionable insights tailored for patients, providers, caregivers and community leaders.

**Invest in research, education, and training that catalyzes translational advances in precision medicine**
This strategy will emphasize the development of biomedical research technologies to advance knowledge and application of omics profiles and associated disciplines (e.g., nutrition, kinesiology, etc.) that can readily translate into the health and wellness of individuals and populations. This strategy includes key investments in small, high-impact/high-risk pilot projects as well as larger, longer-term collaborative projects in comparative disease modeling, bioinformatics, environmental monitoring and lifestyle analyses that impact precision medicine. In addition, investments leading to training and other types of grants will be made in education and training of public on the science and practice of precision medicine.

**Lead outreach and inclusion activities to forge strategic alliances and public/private partnerships**
This strategy will establish common ground and shared interests in precision medicine with members of the local, statewide and national community of academic, industry and government leaders. This strategy will emphasize policies and best practices to maximize health and wellness over a lifetime and favor a person-centric approach to health care. This strategy will also create a continuum of the precision medicine paradigm from the individual to the population. Alliances with other University of California institutions are already in place and the strength of the system is evident.

**MOVING FORWARD**
Creating a state-of-the-art Center for Precision Medicine will require investments in pilot studies/seed grants, infrastructure and human capital.

Start-up funding will support pilot studies that facilitate significant preliminary data by discipline, pilot studies that stimulate cross-disciplinary efforts much like the RISE awards, infrastructure that fills gaps in technology and methodology, and workforce development and education innovation from pre-college to graduate and professional schools. Support for recurrent, in-depth conferences will position UC Davis as a focal point for precision medicine.

Long-term funding will support faculty—six faculty positions over five years—and an endowed position for the faculty director.

The total cost is estimated to be $25 million in start-up funding and $10 million per year for five years.