

May 20, 2016 | By UC San Diego Communications

## Ahead of the Curve

**From climate change to brain activity mapping to studies of the microbiome, the campus leads the way in global efforts with big payoffs for humanity**



*From Left, Veerabhadran Ramanathan, Rob Knight and Ralph Greenspan*

Two months before the historic climate agreement in Paris, where representatives from nearly 200 countries pledged to reduce greenhouse emissions, a smaller group of climate experts and politicians gathered at UC San Diego’s Scripps Institution of Oceanography.

Their mission: To come up with recommendations to slow the pace of global warming by “bending the curve” of rapidly rising greenhouse gases in the atmosphere.

Their timing couldn’t have been more perfect. The University of California Carbon and Climate Neutrality Summit, held last October at Scripps, allowed Gov. Jerry Brown, who joined UC President Janet Napolitano at both the UC and Paris summits, to arrive in France with specific scientific recommendations, along with more than 30 UC faculty experts and students, to consider in forging their international agreement.

The idea for last October’s UC summit and its report “Bending the Curve,” came, in part, from renowned Scripps climate and atmospheric scientist Veerabhadran Ramanathan, one of 15 UC San Diego delegates who traveled to the Paris conference last December.

And it was another example of our campus being ahead of the curve, of leading the way, in developing innovative solutions for global problems and rapidly initiating national research efforts in areas with big payoffs for humanity.

“This has been the tradition of our campus from the very start,” says Chancellor Pradeep K. Khosla. “From being the first institution to document rising carbon dioxide levels in our atmosphere, to coming up with specific actions to reduce global warming, to developing new disciplines such as conservation biology, this pioneering spirit is part of the DNA of UC San Diego and it continues today.”

Last week, President Obama announced a major federal research initiative to better understand the microbiome—the communities of bacteria, viruses and other microorganisms that live within and around us. But this national effort comes more than six months after Chancellor Khosla launched a campus-wide Microbiome and Microbial Sciences Initiative and more than a year after the campus, in a prescient move, recruited Rob Knight, one of the world’s leading experts on the microbiome who helped the White House develop and announce the federal microbiome initiative.

Ask Knight, a professor of pediatrics and computer science and engineering and director of the Center for Microbiome Innovation, why he moved his family and his lab—totaling some 25 people—from Boulder, Colorado to La Jolla last year and one of the reasons he cites is the campus’s leadership in developing and carrying out President Obama’s BRAIN Initiative.



*A delegation of Scripps researchers traveled to the Paris climate summit two months after last October’s UC Carbon and Climate Neutrality Summit. Photo by Robert Monroe, UC San Diego*

“The enthusiasm for exploring the links between the microbiome and the brain, among multiple academic units here, was attractive,” Knight says. “The potential to transfer this success to the microbiome is immense at UC San Diego.”

President Obama’s BRAIN Initiative, a \$100-million neuroscience research initiative which the White House developed with the help of UC San Diego’s neuroscience, neurobiology and cognitive science faculty, was launched in April 2013. At the White House announcement were four faculty members—Ralph Greenspan, Nicholas Spitzer, Terry Sejnowski and Dilip

Jeste—along with Chancellor Khosla.

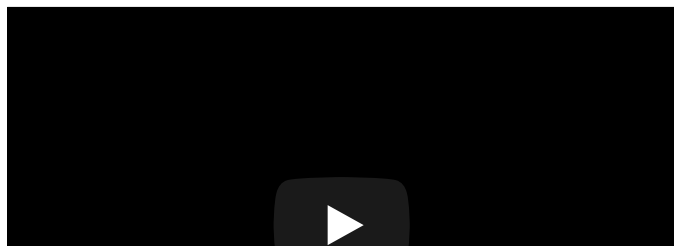
Six weeks later, the campus launched the nation's first academic center devoted to the effort, the Center for Brain Activity Mapping, with Greenspan, a professor of neurobiology and cognitive science, as its founding director. Part of the Kavli Institute for Brain and Mind, CBAM is focused on the technological and biological challenge of recording neuronal activity throughout the brain.


Greenspan, associate director of the Kavli Institute for Brain and Mind at UC San Diego, was very much ahead of the curve when it came to thinking about the future of research on the human brain. He and the Salk Institute's Sejnowski, who also directs UC San Diego's Institute for Neural Computation, had been part of cultivating the audacious idea among neuroscientists of a comprehensive project for studying brain activity in unprecedented detail. But they didn't know the White House was interested until they heard President Obama mention brain mapping in his State of the Union Address in February of 2013. Sejnowski was subsequently tapped to help develop the BRAIN Initiative, short for Brain Research through Advancing Innovative Neurotechnologies, which was formally announced by Obama in April of the same year. It, like the Center for Brain Activity Mapping, has been underway for more than two years now.

Greenspan also played a leadership role in creating the nation's first state grant program specifically for brain-mapping research, called Cal-BRAIN, which was signed into law in 2014, becoming the first state complement to the national initiative. CalBRAIN, which awards grants specifically to California scientists, shares BRAIN's aims: to create the next generation of neuroscience tools that can help scientists answer fundamental questions about the brain – and that might one day also be put to use in the prevention and treatment of Alzheimer's disease, Parkinson's disease, brain injury, stroke, epilepsy, autism, mental illness or depression.

The federal and state initiatives and CBAM are all expressly encouraging collaborations between scientists from different disciplines. Mapping brain activity – an undertaking as big if not bigger than the one to map the human genome – will need researchers from engineering and neuroscience (including cognitive science, psychology, neurology and psychiatry), nanoscience and radiology, chemistry and physics, computer science and mathematics.

Top-ranked researchers across many disciplines and a spirit of interdisciplinary collaboration, fostered in part by UC San Diego's relative youth among major research universities, has been an attractive lure to attract senior scientists looking to create





comprehensive research programs on our campus. That's one of the reasons Knight believed he could build a world-renowned microbiome research program here.

“To my knowledge, UC San Diego is unique in building a strong technology development dimension that spans medical, biological and environmental applications of microbiome research,” he says.

But perhaps the most attractive draw was the commitment he received from the campus to support the kind of research effort that will be the envy of the world. “What attracted us was the fact that microbiome research had been identified as a top priority by the School of Medicine’s research council,” he explains. “From the beginning, we’ve had strong institutional commitment to making UC San Diego the best place on earth to study the microbiome.”

Knight’s expertise in both biology and computer science, combined with his commitment to collaboration and resource sharing to advance research around the world, made him an ideal joint recruit for the UC San Diego School of Medicine and Jacobs School of Engineering. He studies the distinct communities of bacteria, viruses and other microorganisms that live within and around us. He’s particularly known for developing a powerful genetic sequencing technique that allows researchers to differentiate unknown microbes in a sample. Using this method, his research group and others are finding that the trillions of microbes living with us are critical contributors to health and disease risk.

Before the Obama microbiome initiative was crafted, Knight co-authored a paper in the journal *Science* that called for a “Unified Microbiome Initiative,” a federal effort to fund, coordinate and accelerate microbiome research across the nation. He later helped organize a scientific meeting in Washington that focused on the future of human microbiome science, which led to invitations to testify before Congress on the importance of the field and to meet with new leaders in the White House’s Office of Science and Technology Policy.

“These discussions, as well as input from many others, were instrumental in building enthusiasm for what has now become the National Microbiome Initiative,” Knight says.

The campus-wide microbiome initiative, by contrast—developed by Knight and Kit Pogliano, a professor of biology—is a research and education effort that will leverage the university’s strengths in science, medicine, engineering and the humanities to produce a detailed understanding of microbiomes and methods for manipulating them for the benefit of human health and the environment.

Knight leads the research-focused Center for Microbiome Innovation, while Pogliano directs a student-centered Microbial Sciences Graduate Research Initiative. Both will draw faculty and students from nearly every corner of the campus and every discipline.

While rapidly developing new fields has been a long tradition at UC San Diego, maintaining a leadership role in those fields and using the institution's expertise to provide an authoritative source of advice on national issues and global problems has also been an important trait of faculty on the campus.

The science of climate change, for example, started at Scripps with the Keeling Curve, developed by Charles David Keeling, a faculty member there who began in 1958 measuring concentrations of carbon dioxide in the atmosphere at Mauna Loa Observatory in Hawaii. It is one of the most recognizable images in modern science and is the foundation for the science of climate change.

So when researchers at Scripps and other divisions of UC San Diego comprising physical scientists, political scientists and students – accompanied Gov. Jerry Brown to the Paris summit, they were given the opportunity to participate in panels on the science of climate change and drew the attention of negotiators and conference attendees to a range of climate change-related issues such as ocean acidification and deoxygenation. They also proposed solutions such as mitigating so-called short-lived climate pollutants like soot and methane in addition to curbing the carbon dioxide emitted by the burning of fossil fuels.

The UC San Diego delegation hoped to raise awareness of the importance of the oceans in regulating climate change. When the landmark agreement to fight climate change was signed on Dec. 12, the preamble to the document mentions that the signatories note “the importance of ensuring the integrity of all ecosystems, including oceans.” While this may not initially seem significant, it is the first explicit mention of the oceans in the 21-year history of the annual climate negotiations. More importantly, inclusion of this small passage acknowledges that the world's main regulator of climate cannot be ignored, and could eventually lead to more ocean protections in future international climate agreements.

“Overall, I'm extremely happy that we now have a framework,” says Ramanathan, who was pleased with the outcome of the conference, even if the agreement does not achieve the slowing of global warming that most scientists believe is necessary. “I think of it as a major step forward. I still hold onto my view that it's not too late to avoid disaster.”

Natalya Gallo, a UC San Diego graduate student who served as a panelist at the conference agrees.

“The Paris agreement moves us toward a world that is more sustainable, cleaner and healthier,” she says. “Much work remains to be done, but for today, we can celebrate a victory.”

---

#### MEDIA CONTACT

**Heather Buschman**, 858-249-0456, [hbuschman@ucsd.edu](mailto:hbuschman@ucsd.edu)

UC San Diego’s [Studio Ten 300](#) offers radio and television connections for media interviews with our faculty, which can be coordinated via [studio@ucsd.edu](mailto:studio@ucsd.edu). To connect with a UC San Diego faculty expert on relevant issues and trending news stories, visit <https://ucsdnews.ucsd.edu/media-resources/faculty-experts>.