UC SANTA BARBARA

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Visionaries

Two scientists at UC Santa Barbara whose work has contributed in significant ways to our understanding of nature and of our place in it have been recognized by the John Simon Guggenheim Foundation.

Brain scientist Miguel Eckstein and evolutionary biologist Todd Oakley are recipients of 2019 John Simon Guggenheim Fellowships. The prestigious awards are given to those whose work adds “to the educational, literary, artistic, and scientific power of this country, and also to provide for the cause of better international understanding.”

“I am delighted to congratulate both Miguel Eckstein and Todd Oakley on these prestigious fellowships, as they are very competitive awards that recognize exceptional scholarship,” said Pierre Wiltzius, dean of mathematical, life and physical sciences. “Eckstein’s work in the field of visual perception holds great promise for the future of medical imaging and computer vision systems, while Oakley’s research on the evolutionary path of visual systems helps illuminate the origins of incredibly complex traits. We are so proud to call them both members of our faculty.”

Both honorees conduct research associated with vision, one of the most intimate and powerful ways living things connect to the world. While Oakley studies the evolution of complex and diverse visual systems, shedding light on convergent evolution — one of the major mechanisms of life on Earth — Eckstein seeks to understand how the human brain achieves the highly efficient and remarkable

ability to see. And in turn he works with engineers to improve the way computers "see."

"I am grateful and humbled for being selected from among what are surely many equally deserving candidates," Eckstein said. "The Guggenheim Fellowship is unique and holds a special place — an honor that scientists share with artists, writers and musicians."

Added Oakley, "I am so grateful to the Guggenheim Foundation for this recognition and to many colleagues and students for their support and discussions. The funds from the fellowship will allow me to discover new biodiversity in our oceans and explore how nature created it."

In the Blink of an Eye

If you've ever picked your friend out from a crowd, found the right key from a ring of similar keys, or sensed a stranger's feelings from their expression, you have accurately performed sophisticated, complex perceptual tasks to which the world's most powerful computers are just starting to catch up. These abilities are a benefit of more than 500 million years of evolution, and are so effortless they go practically unnoticed.

Eckstein's research is devoted to breaking down these processes and understanding how the brain — more than a quarter of which is devoted to seeing — selects, prioritizes and categorizes information in, well, the blink of an eye. His work has resulted in surprising insights that not only add to our general knowledge of ourselves and our behaviors, but also help to create a foundation from which to develop the next generation of computer vision and imaging technology that could, for instance, assist with medical diagnoses and visual searches. Eckstein has recently been selected by UC Santa Barbara to participate in and lead the campus's new Mellichamp Academic Initiative, a cluster of faculty researchers focused on mind and machine intelligence.

As a Guggenheim fellow, he plans to study children recovering from congenital blindness after surgery in order to understand how eye movement behavior during childhood development shapes brain mechanisms mediating face recognition.

A native of Argentina, Eckstein came to the United States to study at UC Berkeley, where he obtained bachelors of science in physics and in psychology, and later at

UCLA, where he completed his Ph.D. in cognitive psychology. Prior to joining the faculty at UC Santa Barbara, he worked in the Department of Medical Physics and Imaging at Cedars Sinai Medical Center, and at NASA Ames Research Center.

He credits many people for encouraging him on his path, but Eckstein said he is particularly grateful to be able to combine his research and teaching activities with the opportunity to run a faculty mentorship program for the UC Santa Barbara Dream Scholars — undocumented students who are working to gain a world-class education despite current obstacles.

“Their resilience, in spite of the times, and efforts to carve a bright future are utterly inspiring,” he said.

Seeing the Light

The importance of light and vision to life on Earth cannot be understated. From molecules that react to light to specialized structures that meet an organism’s specific needs — locating prey or a mate, to navigate or to hide from potential predators — visual systems are not only ubiquitous but also diverse, and can provide a way to answer questions of evolution. Why, for instance, do arthropods have such a large diversity of eyes? Why have some organisms evolved eyes several times in their evolutionary histories? Why have members of different animal species evolved similar eyes? How did animals evolve to use light for communication?

To answer these and other mind-boggling questions of evolution, Oakley has studied the development of eyes and visual systems in various organisms, including hydra and jellyfish; chytrid fungi; mollusks, such as cephalopods; and crustaceans. The findings derived from his studies have provided insight into the various strategies organisms have adopted to survive and flourish in their often-changing environments.

Increasingly, Oakley’s lab is studying not only how organisms sense light, but also how some produce light using bioluminescence. “Learning how animals produce light in diverse ways may inspire new tools to use biological light for biomedical applications,” he said.

Oakley received his bachelor’s and master’s degrees from the University of Wisconsin-Milwaukee, and his doctorate degree from Duke University. He completed his postdoctoral studies at the University of Chicago before joining the faculty at UC

Santa Barbara, where he conducts research on multiple projects in evolution, behavior and genomics, and is a member of the campus’s Marine Science Institute.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.