UC San Diego
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Three UC San Diego Professors Win $21 Million from DOD to Lead Innovative Collaborations

UC San Diego faculty members have garnered three of 15 Multidisciplinary University Research Initiative awards granted by the Department of Defense this year. The MURI program supports research by teams of investigators that encompass several traditional science and engineering disciplines to accelerate research progress.

“Our faculty’s success in winning these competitive awards stems from our long history of multidisciplinary work and our strength in establishing effective collaborations across our campus and nation,” said UC San Diego Chancellor Pradeep K. Khosla.

The grants, worth up to $21 million in aggregate, will go to multi-institutional teams led by Neal Devaraj, assistant professor of chemistry and biochemistry in the Division of Physical Sciences, Shaya Fainman, professor and chair of electrical and computer engineering, Jacobs School of Engineering, and William Kuperman, professor and director of the Marine Physical Laboratory, Scripps Institution of Oceanography.

“Innovative thinking and creative partnerships are the hallmarks of our university’s research enterprise,” said Vice Chancellor for Research Sandra A. Brown. “This impressive award validates the bold approach of these and other faculty members and researchers.”

Neal Devaraj, along with UC San Diego researchers Jeff Hasty, Simpson Joseph, and Lev Tsimring and colleagues from Harvard University and University of Colorado Boulder will combine synthetic materials with biological elements in order to create hybrid artificial cells that mimic the form and function of natural cells. By replacing organizing elements of the cell with artificial constructs, they hope to gain fine control of actions within the cell, then explore the consequences of their manipulations. Devaraj believes their effort will lead to breakthroughs in understanding how to develop and control a wholly synthetic biological “chassis” capable of interfacing with engineered biological systems. In the end, their approach should lead to advanced synthetic cells, which could optimize the production of biochemicals that are useful as drugs or fuels, or that can be assembled along with biological circuits to create highly efficient sensors.

Shaya Fainman will be working with UC San Diego engineering professors Eric Fullerton, Paul Yu and Stojan Radic as well as professors Bahram Jalali at UCLA, Xiang Zhang at UC Berkeley and Nasser Peyghambarian at the University of Arizona. They will use computational design and nanofabrication to discover nonlinear optical metamaterials and novel low-energy nanoscale resonant devices for next-generation optical communication, networking, and sensing on a chip side by side with CMOS electronics. Fainman's research group helped to develop the field of nanophotonics to generate, manipulate and control light at the nanoscale. By integrating these nanophotonic devices into lightwave circuits and systems, researchers have already achieved enormous success over the past decades in digital and analog signal and information processing. The nanophotonics technology will enable and revolutionize various information system applications including large data centers, cloud computing, advanced radar technology, and medical devices and systems.

William Kuperman, along with Scripps researchers Bruce Cornuelle, William Hodgkiss, and Peter Gerstoft and colleagues from four other institutions will monitor sounds in the ocean to understand if and how those sounds can be used as a tool for analysis of ocean conditions. The scientists will study the noise from ships off the coast of California and the noise made by ice floes in polar regions to see if they can produce scientifically valuable data even when the sound sources can't be controlled, a task Kuperman described as an extremely difficult challenge in the field of tomographic imaging. The research is laying the foundation for developing a reliable, passive means of enhancing ocean situational awareness, an important component for carrying out U.S. Navy missions, Kuperman added. Research supported by the grant will involve the assimilation of data obtained from the deployment of sound-capturing equipment from ships and autonomous underwater vehicles.

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. 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.