

# Caltech researchers awarded \$10M for molecular programming project

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The National Science Foundation's Expeditions in Computing program has awarded \$10 million to the Molecular Programming Project, a collaborative effort by researchers at the California Institute of Technology and the University of Washington to establish a fundamental approach to the design of complex molecular and chemical systems based on the principles of computer science.

The focus of their study, molecular programs, are collections of molecules that may perform a computation, fabricate an object, or control a system of molecular sensors and actuators. The project aims to develop tools and theories for molecular programming--such as programming languages and compilers--that will enable systematic design and implementation in the laboratory.

Eventually, molecular programs could be used to manufacture nanoscale objects, to create biochemical circuitry to probe the inner workings of cells, and as "programmable therapies" placed within living cells to diagnose and directly respond to diseases.

"Our project is a response to the fact that the molecular systems people are building today are now so complex, and their behavior so intricate, that future progress hinges on developing the intellectual and practical tools for mastering that complexity, the kinds of tools that computer science has already developed for silicon computers," says Erik Winfree, associate professor of computer science, computation and neural systems, and bioengineering at Caltech, and principal investigator on the

project.

"The Molecular Programming Project is one of the 'outputs' from our investment in the Information Science and Technology (IST) initiative over the years," says co-investigator Richard M. Murray, the Thomas E. and Doris Everhart Professor of Control and Dynamical Systems and director of the IST program at Caltech. "The Expeditions program is intended to identify future directions in computing that have the potential to lead to 'revolutionary' changes. The collaborations between the various investigators, many of which were funded by IST, were instrumental in bringing together the team of researchers who are embarking on this project," he says. Examples include research projects and workshops funded by Caltech's Center for Biological Circuit Design, an IST initiative.

The Expeditions in Computing award, sponsored by the NSF's Directorate for Computer and Information Science and Engineering, is designed to provide investigators with the opportunity to pursue "ambitious, fundamental research agendas that promise to define the future of computing and information."

The other members of the collaboration are Jehoshua (Shuki) Bruck, the Gordon and Betty Moore Professor of Computation and Neural Systems and Electrical Engineering at Caltech; Niles A. Pierce, associate professor of applied and computational mathematics and bioengineering at Caltech; Paul W. Rothemund, senior research associate in bioengineering, computer science, and computation and neural systems at Caltech; and Eric Klavins, assistant professor of electrical engineering at the University of Washington in Seattle.

Source: California Institute of Technology

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