

## UCSD physicist receives Young Investigator Award from Arnold and Mabel Beckman Foundation

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FROM ARNOLD AND MABEL BECKMAN FOUNDATION

Terence Hwa, an associate professor of physics at the University of California, San Diego, has been named an Arnold and Mabel Beckman Foundation Young Investigator this year for his work that applies mathematical concepts in physics to biological problems.

Hwa, who joined the UCSD faculty in 1995, will receive an award of \$200,000 for two years from the foundation to conduct his research.

"I am bringing new tools to look at old problems," said Hwa. "This proposal will explore how new theoretical tools, developed for physics, can be applied to biological problems."

For example, Hwa said he will use ideas from mathematics and physics to explore new methods for detecting similarities between long DNA and protein sequences.

Molecular biologists routinely compare newly sequenced genes from a given species to known sequences from other species, a first step toward unveiling the structure and function of the new findings. Gene-hunting in this fashion takes advantage of an evolutionary feature in which "conserved" sequences are passed from one species to another. By employing sophisticated algorithms, researchers seek out similarities in sequencing patterns to identify likely genes. This so-called "sequence alignment" is the most widely used mathematical and computational tool in molecular biology.

Hwa's studies suggest a new approach that could speed sequence matching, potentially vital for the identification of vast libraries of new genes that make up the human genome. The approach, he said, is similar to the way physicists calculate the attraction of electrons of an atom to its nucleus.

"If the similarity is weak between sequences," explains Hwa, "then it's like there's not much attraction between the electron and the nucleus, and the atom falls apart. We exploit the physical principle that holds an atom together to sequence matching, so that very weak similarities can be detected." Hwa is hopeful that similar methods can be used to better understand the complex structures and functions of long DNA and RNA molecules.

Aside from biological problems, Hwa is also applying mathematical concepts in physics to other complex scientific problems, such as improving the performance of high-temperature superconductor materials, and aspects of turbulence mixing encountered in the transport of energy in fusion reactors.

"The method I use is actually quite similar to what I use in biology," Hwa said. "In some sense, the biological problems and the superconductor problem and the turbulence problem are all related. We can use similar kinds of methods to address each."

Hwa, who came to UCSD from the State University of New York, Stony Brook where he was an assistant physics professor, already has received several other awards from his work. In 1995, he was named a winner of the Office of Naval Research Young Investigator Award. A year earlier, he won an A.P. Sloan Foundation Research Fellowship; in 1993, Hwa was honored as the Outstanding Young Researcher, from the Overseas Chinese Physics Association.

Hwa received his bachelor's degree in 1986 in physics, biology and electrical engineering from Stanford University; shortly after graduation, he received the Leroy Apker Award from the American Physical Society for the best undergraduate thesis. Hwa received a Ph.D degree in physics from the Massachusetts Institute of Technology, was awarded a postdoctoral fellowship in physics from Harvard University, and was subsequently hired as a five-year member of the Institute for Advanced Study at Princeton, N.J.

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