White House Awards UC San Diego Bioengineering Professor Shu Chien National Medal of Science

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President Barack Obama today named University of California, San Diego bioengineering professor Shu Chien one of the seven eminent researchers to receive the National Medal of Science, the highest honor bestowed by the United States government on scientists and engineers. Chien is the only engineer among the seven medalists.

Shu Chien, a professor in the Department of Bioengineering at the UC San Diego Jacobs School of Engineering, is a world leader in the study of how blood flow and pressure affect blood vessels. Chien is a university professor of bioengineering and medicine at UC San Diego and Director of the UC San Diego Institute of Engineering in Medicine.

"Professor Shu Chien is truly remarkable. He is one of only 11 renowned scholars who are members of all three U.S. national institutes - the National Academy of Sciences; National Academy of Engineering; and the Institute of Medicine," said Chancellor Marye Anne Fox. "For more than 20 years, Shu has collaborated with UC San Diego colleagues across the campus and the Health Sciences while mentoring a generation of students and postdoctoral researchers. We celebrate this tremendous honor and congratulate him."

An expert on how blood flow and pressure affect vessels, Chien's research has led to the development of better diagnostic tests and treatments for atherosclerosis, which refers to the hardening of the arteries, and other diseases.

"Shu Chien played a crucial role in forming the Jacobs School's Department of Bioengineering and building it into a world class institution that is ranked number one for biomedical engineering by the National Research Council," said Frieder Seible, Dean of the Jacobs School of Engineering. "As Director of the UC San Diego Institute of Engineering in Medicine, Shu is now leading efforts to further strengthen research and educational collaborations between all six departments of the Jacobs School of Engineering and the School of Medicine and the Skaggs School of Pharmacy."

Chien joined UC San Diego in 1988 after he was recruited by Y.C. Fung and Benjamin Zweifach, who co-founded the bioengineering program at UC San Diego with Marcos Intaglietta.

"I regard recruiting Shu as my greatest contribution to UCSD," said Fung in 2005 when Chien received the Distinguished Lifetime Achievement Award from the Asian American Engineer of the Year Awards Committee. Chien has held the Y.C. Fung Endowed Chair in Bioengineering since 2006.

The Department of Bioengineering at the UC San Diego Jacobs School of Engineering is a leader in systems biology, regenerative medicine and multi-scale bioengineering focused on understanding, diagnosis and treatment of human disease.

The UC San Diego Institute of Engineering in Medicine has research centers focusing on health and disease in cardiac, musculoskeletal, retina, and neurological systems; on medical devices and instrumentation technologies; multiscale imaging in living systems; and nano-medicine and nano-engineering. The institute also focuses on training, industry cooperation and entrepreneurism.

Shu Chien's Research

Chien is widely known as an exceptional researcher, instructor, mentor, and citizen of the university and his professional community. His research integrates biomedical sciences and engineering across the biological hierarchy, from genes and molecules to cells and tissues to organs and systems.

Some of his more recent research has focused on the effects of mechanical forces - pressure and flow - on cellular functions such as gene expression. When genes change their expression, the proteins will change, and proteins are the major determinants of cell functions such as growth, migration and programmed cell death. His research has shown how the mechanical forces generated by circulating blood affect the functions of endothelial cells inhealth and disease. Endothelial cells line the interior surface of the body's blood vessels throughout the circulatory system.

Chien's research could explain why atherosclerotic lesions form preferentially at branches of coronary arteries. More specifically, this research uncovered the mechanical and molecular mechanism of the preferential distribution of atherosclerosis in regions of complex flowsuch as arterial branch points. He showed that the differential signal processing and gene expression of endothelial cells in these regions as compared to regions resistant to atherogenesis, which is the process by which plaque forms in the arteries. These studies are being performed in collaboration with Julie Li and Shankar Subramaniam, professor and chair, from the Department of Bioengineering at UC San Diego, professors Juan Lasheras and Juan Carlos del Alamo from the Department of Mechanical and Aerospace Engineering at UC SanDiego, John Shyy from UC Riverside, Peter Wang from the Univ. of Illinois Urbana-Champaign and others in the United States, China and Taiwan.

Chien has worked with Karl Willert, director of UCSD's stem cell core facility, and postgraduate researcher David Brafman, to develop an automated, computerized process that allows scientists to identify the best environments to grow stem cells. The experiments require mixing six proteins in a wide range of combinations. The machine developed by Chien's team allows researchers to test hundreds of them at once. With UC San Diego bioengineering professor Shyni Varghese, these techniques are being extended to the screening of synthetic polymers for the optimal growth and development of stem cells. With UC San Diego bioengineering professor Adam Engler and material science professor Shungho Jin, Chien has examined how the physical and geometrical properties of the environments where stem cells grow can influence their development.

With UCSD bioengineer Adam Engler and material science professor Shungho Jin, Chien has examined how the physical properties of the environments where stem cells grow can influence their development. For example, a stiffer matrix can steer the cells toward becoming more like bone cells, while a softer matrix leads to brain-like ones.

Shu Chien Biography

Chien was born in Beijing, grew up in Shanghai and was a premed student at National Peking University when he and his family went in 1949 to Taiwan during the turmoil of the Communist takeover of China. He received his medical degree from National Taiwan University and a Ph.D. in Physiology from Columbia University, where he served as professor from 1969 to 1988. During a sabbatical from 1987 to 1988, Chien founded Taiwan's Institute of Biomedical Sciences in Academia Sinica.

Chien is a Fellow of the American Academy of Arts and Sciences and has published more than 500 archival journal articles and 11 books. He has served in leadership positions in the Federation of American Societies for

Experimental Biology (FASEB), the American Institute for Medical and Biological Engineering (AIMBE), as well as other professional societies.

National Medal of Science

The National Medal of Science was created by statute in 1959 and is administered for the White House by the National Science Foundation. Awarded annually, the Medal recognizes individuals who have made outstanding contributions to science and engineering.

"Each of these extraordinary scientists, engineers, and inventors is guided by a passion for innovation, a fearlessness even as they explore the very frontiers of human knowledge, and a desire to make the world a better place," President Obama said. "Their ingenuity inspires us all to reach higher and try harder, no matter how difficult the challenges we face."

Nominees are selected by a committee of Presidential appointees based on their extraordinary knowledge in and contributions to chemistry, engineering, computing, mathematics, and the biological, behavioral/social, and physical sciences.

National Medal of Science awardees with current faculty affiliations with UC San Diego: Margaret Burbidge, Shu Chien, Chancellor Marye Anne Fox, Michael H. Freedman, Yuan-Cheng Fung, Craig Venter, Andrew Viterbi and Walter Munk. Past UC San Diego National Medal of Science recipients include Roger Guillemin, Charles Keeling, George Palade, Linus Carl Pauling, Roger Revelle, Marshall Rosenbluth and Harold Urey.

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