UC San Diego Bioengineering Professor Wins Engineering Prize

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The National Academy of Engineering has announced that Yuan-Cheng "Bert" Fung will receive the 2007 Fritz J. and Dolores H. Russ Prize, a $500,000 award recognizing engineering achievement that significantly improves the human condition. Fung, a professor emeritus of bioengineering at UC San Diego's Jacobs School of Engineering, was acknowledged "for the characterization and modeling of human tissue mechanics and function leading to prevention and mitigation of trauma."

Previous recipients include inventors of the first human heart pacemakers, kidney dialysis, and biosensors that enable open heart surgery and diabetes patients to self-monitor glucose levels.

"I was very surprised and very proud that such a great prize would come my way," Fung said.

Fung's research is the basis for the entire field of automotive safety design - all automobile crash tests today rely on his fundamental studies about tissue response. "Since the widespread application of quantitative biomechanics into motor vehicle restraint systems design in the early 1980s, we have experienced about a 30 percent reduction in motor vehicle fatalities," said Robert C. Lange, executive director of structure and safety integration for General Motors.

Fung is widely known as the "father of modern biomechanics" for pioneering the application of quantitative and analytical engineering principles to the study of the human body and disease. Fung's accomplishments and insights have directly contributed to designs, inventions, and applications that save lives, mitigate the severity of soft tissue injury, enhance the recovery and functionality of injured soft tissue, and improve the effectiveness and longevity of prosthetic orthopedic devices. His research contributed to the development of artificial skin, which has accelerated healing for millions of people with burns and other tissue trauma.

"The Russ Prize is a most fitting honor in recognition of Dr. Fung's monumental achievements and immense contributions to bioengineering that have benefited our society in countless ways," said Shu Chien, director of the UCSD Whitaker Institute of Biomedical Engineering and a university professor of bioengineering and medicine.

Comparable to the Nobel Prize, the biennial award was created by the late Fritz Russ, a 1942 electrical engineering graduate of Ohio University, with his wife, Dolores. The Russes established the prize in 1999 with a multimillion-dollar endowment to Ohio University to honor the engineering profession and to attract more individuals to the field.

Fung became interested in the mechanics of the human body after spending 20 years making significant contributions in aeronautics. In the early 1960s, while still a professor at the California Institute of Technology, he began applying his understanding of stress and strain to the study of blood vessels and cells. In 1966, Fung joined UCSD to establish one of the first bioengineering programs in the country and to fully devote himself to studying the mechanical aspects of the body.

Fung's theories on the mechanical properties and functions of blood cells and capillary blood vessels have led our understanding of microcirculation, endothelial biology, and atherosclerosis. His "sheet-flow" theory provided a quantitative description of pulmonary circulation, hypertension, edema, and respiratory distress syndrome. Problems related to severe thorax impact injuries have been solved by Fung's "stress wave propagation" theory.

Morphometric data worked out by Fung on coronary blood vessels, pulmonary vascular tree, and intestines have proved invaluable for theoretical analyses. His quantitative methods for characterizing stress-strain behavior of human tissue -- now known as quantitative biomechanics -- have led to fundamental advances in understanding how tissues interact with dynamic environments.

Fung explained his insights and models in numerous papers and in the classic, enduring reference, *Biomechanics: Mechanical Properties of Living Tissue* (Springer Verlag, 1981), which is credited with improving vehicle design and crash safety. Fung's research has also been used to develop products that protect against explosive compressions, such as personal body armor for military forces and emergency responders.

More recently, Fung directly contributed to tissue engineering through the development of engineered products for treating burns and severe tissue injuries and the development of engineered blood vessels. Furthermore, the application of his theories of biomechanics to orthopedic devices has significantly improved the functional management of soft tissue injuries such as ankle sprains. New research and applications built on Fung's theories will continue for many years to come.

The National Academy of Engineering is an independent, nonprofit institution. Its members consist of the nation's premier engineers, who are elected by their peers for seminal contributions to engineering. The academy provides leadership and guidance to government on the application of engineering resources to social, economic, and security problems. Established in 1964, NAE operates under the congressional charter granted to the National Academy of Sciences in 1863.

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