

## **2008 Nobel Prize in Chemistry Shared by UC San Diego Researcher Roger Tsien**

October 8, 2008

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University of California, San Diego Professor Roger Tsien, Ph.D., will share the 2008 Nobel Prize in Chemistry with Osamu Shimomura of the Marine Biological Laboratory in Woods Hole and Boston University School of Medicine, and Martin Chalfie of Columbia University in New York. The scientists are being honored for the discovery of Green Fluorescent Protein (GFP) and seminal work to design and create fluorescent molecules that enter cells and light up their inner workings.

Announcing the prize in Stockholm, Sweden today, the Royal Swedish Academy of Sciences said: "This year's Nobel Prize in Chemistry rewards the initial discovery of GFP and a series of important developments which have led to its use as a tagging tool in bioscience. By using DNA technology, researchers can now connect GFP to other interesting, but otherwise invisible, proteins. This glowing marker allows them to watch the movements, positions and interactions of the tagged proteins. The impact of his groundbreaking success in the development of colorful, glowing dyes and proteins to track cellular behavior has earned him the Nobel Prize."

Tsien, a professor of pharmacology, chemistry and biochemistry at UC San Diego and a Howard Hughes Medical Institute investigator, has dedicated his career to the development and application of fluorescent protein probes that enable scientists to monitor cellular function. He describes his life's work as "building molecules to look inside of cells, allowing us to see beyond what the human eye can see."

**Images: <http://ucsdnews.ucsd.edu/newsrel/science/NobelPrize08.asp>**

"Our work is often described as building and training molecular spies...molecules that will enter a cell or organism and report back to us what the conditions are, what's going on with the biochemistry, while the cell is still alive," said Tsien.

In particular, his laboratory has engineered dyes that gently infiltrate their target, without disrupting or harming the cell, opening new windows into cellular function. Previously, dyes were injected, violating the cell membrane and limiting studies to larger cells. He and his collaborators also improved and modified Green Fluorescent Protein (GFP) from jellyfish and analogous red fluorescent proteins from corals to track a wide variety of cell signals. Tsien's methods have led to new opportunities to monitor and image multiple molecular processes simultaneously, in all sizes and types of cells, without disrupting cell function.

"We not only build protein molecules to send into cells, but we also teach cells to make their own dyes," said Tsien. "These proteins are trained from birth to be our eyes and ears inside the cells." He added that over his career, he has received honors "not because I am a particularly good chemist or biologist, but because we have harnessed chemistry to help solve important biological problems."

"I am delighted to join the entire UC San Diego community, including the hundreds of scientists and graduate students worldwide who have collaborated with him, in congratulating and saluting Roger Tsien for winning this year's Nobel Prize in chemistry," said UC San Diego Chancellor Marye Anne Fox. "Roger joins the extraordinary

and prestigious ranks of Nobel Laureates at UC San Diego whose incredible scholarship is dedicated to improving the lives of people throughout the world."

A profile on The Howard Hughes Medical Institute web site describes Tsien's work: "He is renowned for developing multicolored fluorescent proteins that track the movement of calcium within cells, and has genetically modified molecules that make jellyfish and corals glow, creating fluorescent colors in a dazzling variety of hues. The fluorescent proteins have been used by scientists worldwide to track where and when certain genes are expressed in cells or in whole organisms. Most recently, he has begun to build on this work to develop a novel way to image and possibly even deliver specially targeted drugs to cancer tumors."

Tsien recently has set his sights on imaging and treating cancer, stating that "I've always wanted to do something clinically relevant in my career, if possible, and cancer is the ultimate challenge." He and his colleagues have devised new strategies to target imaging agents or chemotherapy drugs to tumors and are trying to translate these approaches to the clinic.

"Dr. Tsien's work has, and will continue to have, an enormous impact on human health by enabling researchers to study cells related to disease in detailed ways that had never before been possible," said David Brenner, M.D., Vice Chancellor for Health Sciences and Dean, UCSD School of Medicine.

"Along with his remarkable scientific achievements, Roger has also dedicated much of his time to working with and inspiring high school science students and teachers, introducing them to the wonders of DNA research through hands-on experiments in his laboratories," said Arthur B. Ellis, Ph.D., Vice Chancellor for Research at UC San Diego. "With this selection, the Nobel Prize Committee has not only honored an outstanding chemist, but a researcher and faculty member whose influence reaches far beyond the university."

Tsien attended Harvard College on a National Merit Scholarship, graduating at age 20 with a degree in chemistry and physics. He received his doctorate degree at the University of Cambridge where he was a Marshall Scholar. As a graduate student at Cambridge, he developed molecules to track and control the levels of calcium inside cells, levels that play a major role in the regulation of nerve impulses, muscle contraction, and fertilization.

After postdoctoral work at Cambridge, he moved to the University of California, Berkeley, where he rose to professor of physiology. He moved to UC San Diego in 1989.

At UCSD, Tsien's lab began improving and exploiting a green fluorescent protein from *Aequorea victoria*, a jellyfish that glows brightly in the dark. He and his collaborators also created variants of the protein with other colors. Introducing this molecule or its variants into a cell made it possible to follow all kinds of biochemical processes within living cells 'in real time' - they are literally made visible.

"Tsien's imaginative and skillful use of chemistry to illuminate the machinery of living cells has revealed essential biological workings that were previously hidden from view," said Mark Thiemens, Ph.D., Dean of the Division of Physical Sciences at UC San Diego.

In 2002, Tsien was awarded the Dr. H.P. Heineken Prize for Biochemistry and Biophysics by the Royal Netherlands Academy of Arts for "his extraordinary and unique contribution to the development of a series of methods and techniques for measuring and visualizing processes within and between cells." The Academy stated: "Among other things, the many molecules that Tsien's laboratory has developed enable the transmission of signals between cells to be tracked. They can also be used to monitor intracellular acidity and to follow the transmission of sodium and calcium within cells. (His) methods are now widely used by other researchers for different purposes, such as searching for the factors which cause the creation of malignant cells. Tsien himself is responsible, among other things, for laying bare a molecular mechanism involved in the synaptic adaptive capacity of the brain."

Tsien is a member of the Institute of Medicine, which advises the nation on improving health, the National Academy of Sciences, and the American Academy of Arts and Sciences. Among his many awards and recognitions, he also received the J. Allyn Taylor International Prize in Medicine from the Robarts Institute in London, Ontario (2005); was co-recipient of the Lewis S. Rosenstiel Award for Distinguished Work in Basic Medical Science in 2006; and was elected as a Foreign Member of the Royal Society of London in 2006. His research is funded by the National Institutes of Health, the Howard Hughes Medical Institute and a Department of Defense Breast Cancer Innovator Award.

**Past UC San Diego Nobel Prize winners include:** Renato Dulbecco, 1975, physiology/medicine; Harry Markowitz, 1990, economics; Mario J. Molina, 1995, chemistry; Sydney Brenner, 2002, medicine; Clive W.J. Granger and Robert F. Engle, 2003, economics. The 2007 Nobel Peace Prize was awarded to former vice president Al Gore and the Intergovernmental Panel on Climate Change (IPCC), whose roster of researchers lists nearly two dozen Scripps Institution of Oceanography scientists including Mario Molina, Veerabhadran Ramanathan, Richard Somerville and Lynne Talley.

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