



# NOBEL TRADITION

## A HISTORY OF UC BERKELEY'S LAUREATES

**W**HAT DO PLUTONIUM, the Calvin Cycle, game theory, laser beams, and the Big Bang have in common? They were all invented, discovered, or confirmed by UC Berkeley faculty who were awarded the Nobel Prize. UC Berkeley has an impressive history of Nobel laureates: Since the prize originated in 1901, 20 UC Berkeley faculty and 24 alumni have been awarded the Nobel Prize. Here is the story of Berkeley's Nobel tradition, from the Prize's surprising origin (it owes its existence to dynamite), to Berkeley's most recent recipi-

ent, cosmologist George Smoot, who says that the title of Nobel laureate is "kind of like Miss America, but it doesn't go away at the end of the year." With the academic prestige (and two gigabytes of congratulatory email) comes a sense of social responsibility.

### AN EXPLOSIVE BEGINNING

The Nobel Prize is named for Alfred Nobel, a Swedish scientist, inventor, and man of industry who conducted research on the explosive properties of nitroglycerine. After the

nitroglycerine-related death of his brother and the explosion of one of his factories, he sought to create a more stable explosive. Combining dangerously volatile nitroglycerine with diatomaceous earth, he created dynamite, and its popularity in military munitions made him wealthy.

Nobel's obituary was accidentally published eight years before his death. "The Merchant of Death is Dead," proclaimed one headline. Loath to leave behind the legacy of destruction that this obituary described, he stipulated in his

1939



**ERNEST O. LAWRENCE,  
PHYSICS (1939)**

Invented the cyclotron, which uses magnetic fields to accelerate charged particles, inciting nuclear reactions.



**JOHN NORTHROP & WENDELL STANLEY,  
CHEMISTRY (1946)**

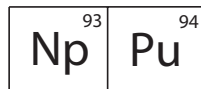
Northrop was the first person to isolate a pure enzyme and Stanley was the first to isolate a virus.

1946

1949

**WILLIAM GIAUQUE,  
CHEMISTRY (1949)**

Invented a magnetic refrigeration system, with which he was able to decrease the temperature nearly to absolute zero (-237.15°C).



**EDWIN MC MILLAN & GLENN SEABORG, CHEMISTRY (1951)**  
McMillan discovered neptunium and Seaborg discovered plutonium.

1951

1959

**OWEN CHAMBERLAIN & EMILIO SEGRÈ,  
CHEMISTRY (1959)**  
Discovered the anti-proton.



1960

**DONALD GLASER,  
PHYSICS (1960)**

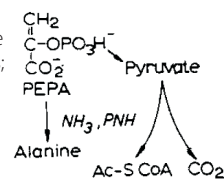
Invented the bubble chamber, which allows scientists to study the movement of atomic particles.



1961

**MELVIN CALVIN,  
CHEMISTRY (1961)**

Explained how plants use carbon in photosynthesis; hence, the Calvin Cycle.



1964



**CHARLES TOWNES,  
PHYSICS (1964)**

Invented the maser, which amplifies waves into an intense beam and was a precursor to the laser.

will that his enormous fortune be awarded to people whose work and discoveries benefited mankind. Nobel wanted prizes to be created in five categories: physics, chemistry, physiology or medicine, literature, and peace. A economics prize in memoriam of Nobel was added in 1968.

Nobel died in 1896, but the first prizes were not awarded until 1901. Nobel's family disagreed with his wishes, and the establishment of the prize was delayed by years of conflicts. It also took some time to decide how the winners would be selected.

It is a long process from nomination to medal. First, a potential laureate must be nominated in a prize category, such as physics. Qualified nominators for physics include members of the Royal Swedish Academy of Sciences, members of the Nobel Committee for Physics, previous Nobel laureates in physics, physics professors at universities in Sweden, Denmark, Finland, and Norway, as well as at six other international universities, and other scientists selected by the Academy—a total of about 3,000 people. Each year, 250–350 physicists are nominated. The aforementioned Nobel Committee for Physics (five members of the Academy) then consults with outside experts to narrow down the list. Finally, the Royal Swedish Academy of Sciences votes on the winner. Ever wonder if you've been nominated for a Nobel Prize? Sorry, you'll be a professor emeritus before you find out: the names of nominees are kept secret for 50 years.

## UC BERKELEY'S NOBEL LAUREATES

In 1939, the Royal Swedish Academy of Sciences declared Berkeley professor Ernest O. Lawrence the winner of the Nobel Prize in Physics. Lawrence, a nuclear physicist, invented the cyclotron, a device that accelerates charged particles so they travel at great speeds. Atoms of a target element are bombarded with the high-speed particles. Upon impact, the particles and target element recombine and decay, briefly producing a new element. Lawrence's invention led to the discovery of many new elements, as well as hundreds of radioactive isotopes.

**"I have the responsibility to use the title as a positive force so that science and education continue to prosper."**










Like Lawrence and the cyclotron, the Nobel Prize often is awarded to the inventor of a machine or technique that leads to new discoveries. For instance, in 1952, Cal physicist Donald Glaser invented the bubble chamber, which allowed scientists to track the movement of charged particles. This invention was a major contribution to the field of physics, and Glaser received the Nobel Prize in 1960. Later, Luis Alvarez, another UC Berkeley physicist, built upon Glaser's bubble chamber design. He filled the chamber with hydrogen instead of ether, which meant that the movement of atoms could be tracked more precisely. Alvarez received the Nobel Prize in 1968.

Another UC Berkeley invention with subsequent modifications that resulted in multiple Nobel Prizes is the laser. Charles Townes won the prize in Physics in 1964 for developing the maser (microwave amplification by stimulated emission of radiation), a precursor to the laser. Two additional Nobel prizes went to UC Berkeley faculty who continued Townes's research with lasers. Yuan T. Lee won the Prize in Chemistry in 1986 for developing a way to send streams of particles, like beams of light, towards other streams of particles, which allowed scientists to look at chemical reactions in a new way. Later, Stephen Chu used laser

beams to cool gasses to very low temperatures. In a 2005 lecture by several Nobel laureates, "Berkeley's Nobel Tradition," Chu described how these beams of supercooled gases could hold an atom steady in space, "the way a tractor beam might

hold on to a starship." Scientists have used the atom trap to study the structure of atoms, and Chu won the Nobel Prize in Physics for this work in 1997.

In all, UC Berkeley faculty have won eight prizes in physics, seven in chemistry, four in economics, and one in literature. Berkeley's most recent Nobel recipient is George Smoot, who shared the 2006 Prize in Physics with John C. Mather of NASA's Goddard Space Flight Center. Smoot and Mather were in charge of building and launching NASA's Cosmic Background Explorer satellite (COBE). They used data from this satellite to produce images of the remnant light of the Big Bang, which showed that it has

1968	1980	1983	1986	1994	1997	2000	2001	2006
 <p><b>LUIS ALVAREZ, PHYSICS (1968)</b> Improved upon Glaser's bubble chamber design by using hydrogen instead of ether inside of the chamber.</p>	<p><b>CZESLAW MILOSZ, LITERATURE (1980)</b> So far, the only Berkeley faculty member to win the Nobel Prize in Literature. Milosz was an author and poet, and wrote critiques of communism.</p> 	<p><b>GERARD DEBREU, ECONOMICS (1983)</b> Created the theoretical framework that describes the law of supply and demand.</p> 	<p><b>YUAN T. LEE, CHEMISTRY (1986)</b> Developed molecular beam devices that allow scientists to view chemical reactions.</p> 	<p><b>JOHN HARSANYI, ECONOMICS (1994)</b> Used game theory to explain human behavior in economic and political conflicts.</p> 	<p><b>STEPHEN CHU, PHYSICS (1997)</b> Used lasers to make supercooled gases that could hold on to an atom, according to Chu, "the way a tractor beam might hold on to a starship."</p> 	<p><b>DANIEL MCFADDEN, ECONOMICS (2000)</b> Incorporated human behavior into economic models of decision-making.</p> 	<p><b>GEORGE AKERLOF, ECONOMICS (2001)</b> His theories explained how, when buyers and sellers don't have access to the same information, markets do not behave according to traditional economic theories.</p> 	<p><b>GEORGE SMOOT, PHYSICS (2006)</b> His work with the Cosmic Background Explorer satellite allowed him to see images of cosmic background radiation, which is thought to be a remnant of the Big Bang.</p> 

hot and cold regions—ripples in space-time left over from the universe's violent origin.

### A NOBEL INCUBATOR

UC Berkeley has all of the ingredients for Nobel-worthy discoveries: well-established programs in physics, chemistry, and economics, faculty members who are leaders in their fields, and top-notch facilities and equipment. But, says Smoot, success in the Nobel arena requires something more.

Smoot makes an analogy to Silicon Valley's entrepreneurs and venture capitalists: an innovative culture is key. Early on, UC Berkeley had large block grants, and "a young person with a great idea was given seed money," says Smoot, and was encouraged to pursue these novel ideas in research and in proposals for additional funding. Older faculty mentored new faculty, making Lawrence Berkeley Laboratory and other departments on campus into "incubators," says Smoot. "You have to know how to mentor [faculty members]. And you have to be a growing university, hiring new people, so you don't forget how to mentor them."

### THERE IS NO MANUAL ON HOW TO BE A NOBEL LAUREATE

George Smoot realized he had won a Nobel Prize when he was awakened by a phone call from Sweden at 2:45 am on October 3, 2006. He had almost no time to prepare for a press conference later that morning. "There is no manual on how to be a Nobel laureate," says Smoot. However, he notes, "I got to talk to Steve Chu," who won a Nobel Prize in 1997, "for 15 or 20 minutes before the press conference." Chu advised him to focus on thanking supporters and funding sources on his first day of Nobel stardom, rather than explaining the science behind it all. However, Smoot wishes he'd had handouts describing his research to give to the press.

After his prize was announced, Smoot received 400–500 invitations to be on committees, to go to functions, and to sign petitions, but you can't attend all the parties and still teach introductory physics. Weeding through the invitations was difficult, says Smoot. But "you need to accept all the Swedish ones."

During the Nobel festivities in Stockholm in December, Smoot and the other laureates, "The Class of 2006," had a roundtable discussion. Says Smoot, "We asked ourselves, 'what does it mean to win a Nobel Prize?'" Some laureates try not to let it change their lives. Others take advantage of the tremendous networking opportunity in order to further their careers.

And others try to use their clout as a Nobel Prize winner to do some good. "This title has weight," says Smoot. "I have the responsibility to use that as a positive force so science continues to prosper, and education prospers."

### FREE PARKING AND SOCIAL RESPONSIBILITY

Here at UC Berkeley, the receipt of a Nobel Prize comes with a complimentary parking spot on campus—a perk if there ever was one. But the great honor of the Nobel Prize comes with a corresponding sense of social responsibility. In January 2006, six of Berkeley's seven living Nobel laureates gathered for a panel discussion about sustainable energy. Steven Chu, George Smoot, Charles Townes, Daniel McFadden, Yuan T. Lee, and Donald Glaser discussed global warming and the dire need to reduce carbon emissions via energy conservation, use of solar power, biofuel technology, and increased fuel efficiency. Smoot brought up the controversial topic of nuclear power, a subject he is well qualified to talk about—in the 1970s, he was on the nuclear reactor safety committee. "Somebody's got to say it," Smoot explained in his interview with the BSR. "Most energy use isn't in the transportation sector," so the potential of biofuels is limited. "Nuclear power is one of the few solutions that make sense." Unfortunately, nuclear power's dangerous reputation "shut the industry down so it never matured," said Smoot. He would like to use his time in the limelight to re-introduce the public to the idea of nuclear power. Education about this and other scientific concepts is a priority for Smoot. "The whole population needs to be technical to be a democracy—to make technical judgments as opposed to emotional judgments."

In line with his priorities, Smoot is using his Nobel Prize money to start a center for cosmological physics here at UC Berkeley. The center will focus on understanding the origins of the universe in detail by taking extremely precise measurements of its properties. Says Smoot, "once you get accuracy [of measurements] to one percent, you start seeing the deviations [from what you expect]. You can test the macroscopic idea," the theory "of how the universe began, evolved, and continues to evolve." The small deviations from theory may be due to microscopic events in the universe which we don't even know about yet.

The center for cosmology will incorporate a high school teachers' academy and will have an extensive and easily comprehensible web site to share cosmological discoveries. This research

about the origins of the universe is broadly important. It is a "cultural heritage for mankind," says Smoot. "Every society has a story of how the universe began. This can be an intellectually powerful, verified creation story. No longer a myth." Understanding the mechanics of the universe, Smoot hopes, will ultimately make people take an active role in understanding the technical issues in society. "The more people believe that the world is rational, the more they will feel personally empowered and feel a sense of responsibility."

### WHAT DO YOU DO FOR AN ENCORE?

In 2006, the Nobel Prize's monetary reward was 10 million Swedish krona, or roughly \$1.4 million, shared equally by multiple recipients in a single category. So far, none of UC Berkeley's Nobel laureates have taken the prize money and retired in luxury in Bermuda—everyone has continued to conduct research. Donald Glaser even changed fields, from physics to molecular biology. In the panel discussion "Berkeley's Nobel Tradition," all of the laureates spoke of their passion for research. Charles Townes is now in his 90s and continues to do research in astrophysics. "I just keep doing science and enjoying it," he says. "There is no reason to stop." So what's the key for students who want a Nobel Prize in the future? "Do the things that you find most interesting," Townes suggests. "Do what you like to do best." ■

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JENNIFER SKENE is a graduate student in integrative biology.

*Want to know more?*

"Berkeley's Nobel Tradition" lecture videos are available online at:

[www.uctv.tv/search-details.asp?showID=11197](http://www.uctv.tv/search-details.asp?showID=11197)

*Laureate panel discussion on sustainable energy:*

[www.berkeley.edu/news/media/releases/2007/01/22\\_nobelists.shtml](http://www.berkeley.edu/news/media/releases/2007/01/22_nobelists.shtml)