



Researcher Caps Off a Celebrated Career with Nobel Prize

Alumna
Carol Greider, '83,
is recognized
for her
discovery of
telomerase in a field
where few women
thrive

BY ANDREA HUEBNER '91



On Christmas 1984, graduate student Carol Greider went into the Blackburn lab at UC Berkeley to check on a research experiment, and found signs of an enzyme that is key to maintaining the integrity of DNA. After a year of study, UC Santa Barbara alumna Greider, '83, and mentor Elizabeth Blackburn published the first paper on telomerase, which builds the telomeres, or caps, at the end of DNA strands.

Twenty-five years later, Greider and Blackburn became 2009 Nobel Prize in Medicine winners, and two of only 10 women worldwide to win the prize in that category. They share the prize with Harvard scientist Jack Szostak for work on telomeres and telomerase.

Today, the telomerase discovery plays a critical role in aging, cell death and cancer research — more than 50,000 articles with telomerase in the title come up in Google Scholar.

UNDERGRADUATE RESEARCH

Although Greider had not dreamed of being a researcher while growing up, despite both her parents having followed that path, she eventually decided to pursue a college degree in the sciences.

While looking at UC schools for college as a high school senior, Greider toured the UC Santa Barbara campus with Biology Professor Beatrice Sweeney, who was on the faculty of the College of Creative Studies. Captivated by the campus and Sweeney's tour as well as the chance to do undergraduate research in an interdisciplinary college, Greider decided to go to UC Santa Barbara to study marine ecology.

Greider began working in research labs during her freshman year — first studying sand crabs, circadian cycles in a dinoflagellate, and then microtubule dynamics. The rotation through different research labs helped Greider determine her research interests lay in an area other than marine ecology.

"The experience that Beazy (Professor Sweeney) and the CCS program provided me, to try out several different laboratory experiences, was instrumental in my finding how much I loved mechanistic thinking and biochemical experiments," Greider told the Nobel Foundation.

Greider continued working on microtubules in Biology Professor Les Wilson's lab throughout her sophomore and

senior years, with a break to study abroad in Germany and work at the Max Planck Institute for Biophysical Chemistry during her junior year. In the Wilson lab, she worked with Kevin Sullivan and David Asai on their experiments, developing her research skills and an interest in graduate school.

"By the time she was a junior at UCSB, Carol was already able to implement effectively her innate ability to assess and move forward. That's the something else that sets Carol apart," said David Asai, who now works at the Howard Hughes Medical Institute.



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GRADUATE SCHOOL AND BEYOND

Despite her extensive research experience and good grades, Greider was granted graduate interviews at only two schools — UC Berkeley and the California Institute of Technology — due to her poor GRE scores. Greider is dyslexic, which affects her ability to take standardized tests. After interviews in which she discussed science and her interests, and explained her dyslexia, she was accepted to both schools.

The deciding factor was her interview with Professor Elizabeth Blackburn in which they discussed Blackburn's research on telomeres, the caps on the end of chromosomes.

"I felt her enthusiasm for chromosomes and telomeres was infectious. I wanted to talk to her more after the allotted interview time so I made plans to come back again the next week to talk in more depth about her telomere work. After that interview, I decided I wanted to go to Berkeley and work with Liz," Greider said in her Nobel laureate autobiography.

During her first year at UC Berkeley, Blackburn gave Greider the challenging task of looking for an enzyme that was responsible for building up the telomeres of DNA.

Facing Page: Carol Greider receives the Nobel Prize in Medicine from King Carl XVI Gustaf of Sweden in December 2009. © POOL/Reuters/Corbis



"We had to be both rigorous and enterprising, and those are exactly the characteristics that Carol has. The combination is a great strength," Blackburn told the National Academy of Sciences newsletter. Blackburn is now the Morris Herzstein Professor of Biology and Physiology in the Department of Biochemistry and Biophysics at UC San Francisco.

Greider and Blackburn refined the research for a year after the Christmas Day discovery before publishing a paper on telomerase in the December 1985 issue of *Cell*.

Continuing work on telomerase research, Greider finished her doctorate, and, in 1988, became one of the first Cold Spring Harbor Laboratory Fellows, an independent position where a researcher can work in her own lab.

"I realized there were so many interesting questions I still wanted to ask about telomerase that I would love to keep working on it," Greider said in her Nobel laureate autobiography.

Greider set about trying to find the telomerase RNA template that builds up the telomeres in DNA. With success and a published paper on that research in 1989, Greider was quickly promoted through the ranks of the laboratory.

When she garnered a grant from the National Institutes of Health, Greider became a full staff member at Cold Spring Harbor Laboratory, and hired her first graduate student, Lea Harrington.

During her time at Cold Spring Harbor Laboratory, Greider worked with Calvin Harley while he was at McMaster University, and found that human telomeres shorten progressively in cells. This finding suggested that telomeres and telomerase may play important roles in cell death and cancer.

COMING FULL CIRCLE

In 1997, Greider joined the faculty at the Johns Hopkins University School of Medicine, and now chairs the Department of Molecular Biology and Genetics. With telomeres playing such a critical role in so many areas, the Greider Lab has several groups researching stem cells, inherited disorders, and telomere functioning.

In addition to the 2009 Nobel Prize in Medicine, Greider

has received several awards for her work on telomerase, including the Gairdner Foundation Award in 1998, the Albert Lasker Award for Basic Medical Research in 2006, and the Dickson Prize in Medicine in 2007. She also received the Paul Ehrlich and Ludwig Darmstaedter Prize and the Pearl Meister Greengard Prize in 2009.

At each step of her career, Greider never fails to name key mentors who helped her develop into the research scientist that she is. Now, she is playing the role of mentor. Half of the Greider Lab is staffed with graduate students, whom Greider finds open to new lines of research.

"One of the lessons I have learned in the different stages of my career is that science is not done alone. . . . The ideas generated are not always the result of one person's thoughts but of the interaction between people; new ideas quickly become part of collective consciousness," Greider told the National Academy of Sciences. "This is how science moves forward and we generate new knowledge."

Carol Greider is being honored with a 2011 Distinguished Alumni Award by the UC Santa Barbara Alumni Association. She will be giving a free public lecture at 7:30 p.m. Jan. 21 at UC Santa Barbara's Corwin Pavilion.

The presentation is titled "How Chromosome Ends Affect Cancer and Age-Related Disease." The event is part of the Frontiers in Cancer Research lecture series that brings prominent scientists to campus to meet with students and faculty members to discuss advances in the treatment and prevention of cancer. It is supported by the Cancer Center of Santa Barbara and the Doreen J. Putrah Cancer Research Foundation in partnership with UCSB.

Carol Greider, second from right in first row, worked with other researchers in Professor Les Wilson's lab when she attended UC Santa Barbara. Photo courtesy of UC Santa Barbara Molecular, Cellular, Developmental Biology Department

Greider is the Daniel Nathans Professor and Director of Molecular Biology and Genetics in the John Hopkins School of Medicine. homewoodphoto.jhu.edu

Greider hugs daughter, Gwendolyn Comfort, and her son, Charles Comfort, during a press conference about her 2009 Nobel Prize. © Matthew Cavanaugh/epa/Corbis