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The Nobel Prize in Chemistry 1993

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## Kary B. Mullis Facts

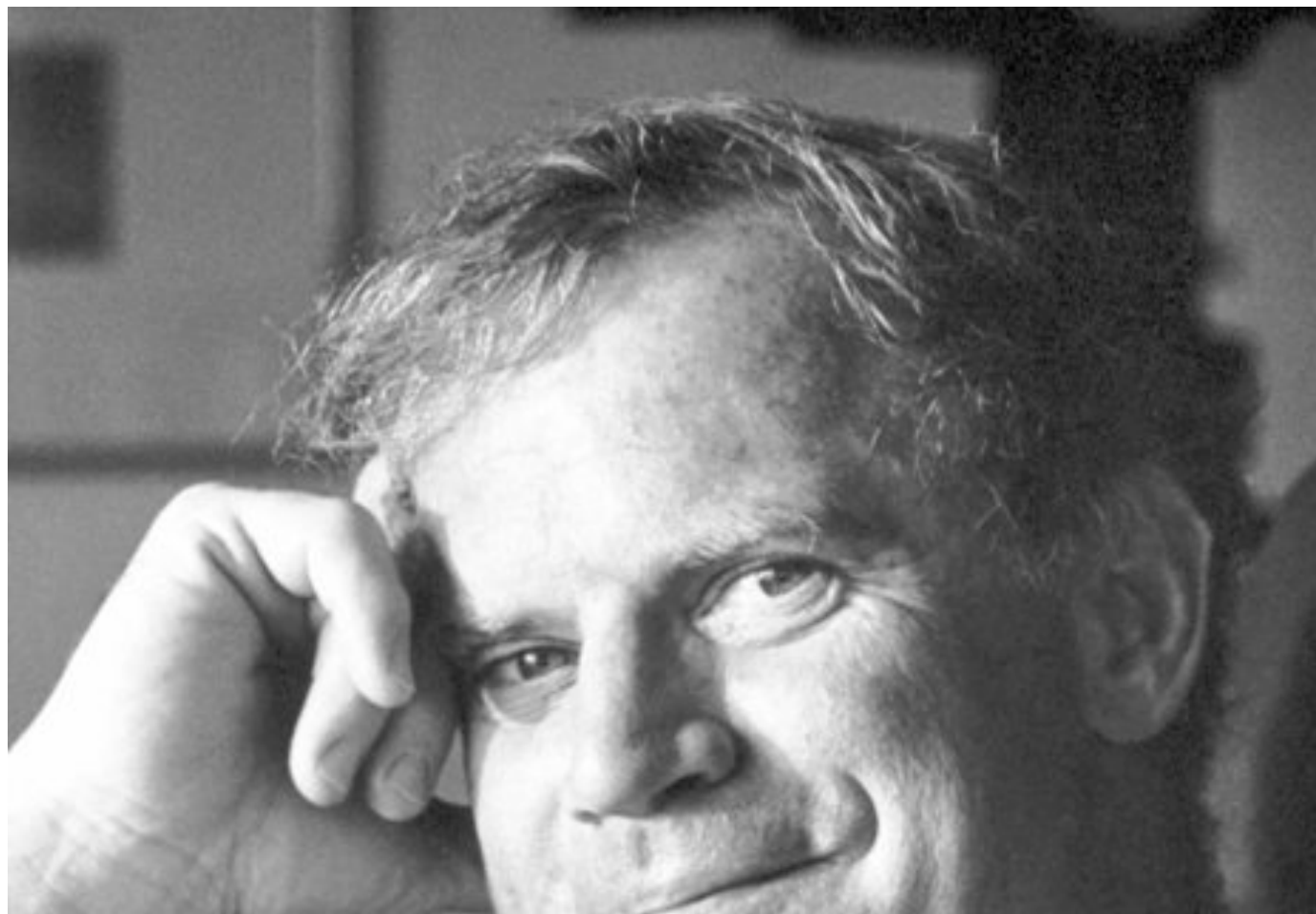




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Kary B. Mullis

The Nobel Prize in Chemistry 1993

Born: 28 December 1944, Lenoir, NC, USA

Died: 7 August 2019, Newport Beach, CA, USA

Affiliation at the time of the award: , La Jolla, CA, USA

Prize motivation: "for his invention of the polymerase chain reaction (PCR) method."

Prize share: 1/2

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## Work

An organism's genome is stored inside DNA molecules, but analyzing this genetic information requires quite a large amount of DNA. In 1985, Kary Mullis invented the process known as polymerase chain reaction (PCR), in which a small amount of DNA can be copied in large quantities over a short period of time. By applying heat, the DNA molecule's two strands are separated and the DNA building blocks that have been added are bonded to each strand. With the help of the enzyme DNA polymerase, new DNA chains are formed and the process can then be repeated. PCR has been of major importance in both medical research and forensic science.

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The Nobel Prize in Chemistry 1993

Kary B. Mullis  
Michael Smith

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## Kary B. Mullis

# Biographical



**M**y father Cecil Banks Mullis and mother, formerly Bernice Alberta Barker grew up in rural North Carolina in the foothills of the Blue Ridge Mountains. My dad's family had a general store, which I never saw. My grandparents on his side had already died before I started noticing things. My mother's parents were close to me all during my childhood, and her father Albert stopped by to see me in a non-substantial form on his way out of this world in 1986. I was living in California. "Pop" died at 92 and wondering what was happening to me out in California, stopped by Kensington for a couple days. My

house afforded a view of San Francisco and the Golden Gate Bridge. His visit was an odd experience. Not at all frightening. I have cultivated the curious things in life and found this one pleasant. "Pop" and I sat in the evenings in my kitchen and I told him about the contemporary California world while we drank beer. I drank his for him as it appeared that although he was very much there for me, he was not there at all for the beer. Many of my friends when I told them of this thought it fanciful. (I think it more likely than much of our math today and at least half of our physics, both of which I like).

Until I was five my immediate family lived near my grandfather's farm where my mother had grown up, and with the exception of a few modern conveniences, had not changed a lot over the years.

My grandfather milked several cows twice a day and supplied the neighbours with dairy products. He liked to go visiting around the county on Saturdays and he also enjoyed the neighbours when they came by once a week with their empty milk jars. He walked them out to their cars and hung over the driver's side window until they drove off. The road was two tire tracks on well mown grass between barbed wire fences, cows off to the right, alfalfa or sometimes corn to the left.

I remember mostly the summers. My mother and aunts presided out on the big screened back porch shelling peas, stringing beans, peeling apples, pears, and peaches. The peaches were peeled with a special machine that had a hand crank and

left a spiraling groove on what was left of the peach. The peels went to the pigs. Everything else went into steaming Mason jars which would go down into the earthen floored cellar. Down there in the dark, and it was always a little moist, were spiders in abundance and magnificent biodiversity. My brothers, and my cousins, and I ventured into the cellar once in a while to inspect the sweet potatoes and the hibernating jars. No one wanted to stay there alone ever, and mostly we played in the woods, the swamp, the orchards, the barn, the granary, which had wasps, and the woodshed, which also had wasps and, like the barn, allegedly, snakes.

We tortured the cows. We sliced apples and slipped them onto the electric fence that contained them in the newer parts of the pasture. Cows like apples and they kept trying. We watched the chickens pecking at the black mud around their chicken house. We heard the squeal of young pigs being castrated by my grandfather and the veterinarian, but we weren't allowed to watch. We heard stories from our moms about balls of fire during thunder storms streaming up the drain pipe that led down to the chicken yard and dancing out of the sink onto the grey floor of the back porch. All the scorched marks had been sanded and painted over by the time we heard about it, and sadly it never happened while we were there. But there were thunderstorms. Rain would come down from a cloudburst in the summer afternoons and the woods would explode with thunder. Our moms would keep us inside and out of the draft from any windows. We... wanted to see those fireballs.

We could play in the attic. Even in the day there was not enough light to keep us calm in the attic, and there were animal-skin coats and unfamiliar garments that lurked in the closets. There was a horrible picture of [Teddy Roosevelt](#) killing a bear. Very bloody. And there were black widow spiders waiting for us always, down in their funnel shaped webs in all the dark corners. It was a thrilling place during a thunderstorm and, like the hay loft of the barn, a place where my pre-adolescent sexuality concerning my cousin Judy, who was one month my senior, would come a little more sharply into focus. We were only nine or ten, but it was there already with it's pressing curiosity. We sometimes kissed. My techniques have improved, but not the thrill.

When my great-grandmother died she was almost a hundred and we were glad to see her go because every time she would come over to my grandmother's house, she would try to kiss all of us. She looked almost a hundred and, heartless, cruel, mindless little children that we were, she repulsed us. She grabbed us anyway and kissed us until she was through. They put her body in a metal casket with gauzy curtains and left it in the living room near the grandfather's clock, which announced the hours

with a number of resonant bongs and marked the half-hours with a single chilling tone. Her body was there for three days until the service on Sunday at Mt Zion Baptist Church. We dared each other to go in and look at her. The adults were unaffected and took their regular meals right in the next room. We found it difficult to sleep. The clock seemed more alive than usual.

My great-grandmother, as I learned from Judy much later, when we were adults, had been an unusual woman in Saw Mills, North Carolina. She lived just a bit on the wild side. She gave birth to my grandmother out of wedlock following an affair with a railroad man named Stowe. We never heard much about him. "Nanny", as we called our great-grandmother, was tolerated by the community because she was the only person for miles around who knew the rudiments of medicine. She provided medical care to livestock, for which she had been trained, but also to people for whom she was the only alternative on her side of the Catawba River. She also ran the post office in Granite Falls. She was the first postmistress anyone had heard about, and rural North Carolinians at the time were not in the mood for new customs, but they accepted what they couldn't avoid. And granite does fall.

When my grandfather, "Pop", James Albert Barker, son of Cary Barker from Cary, N.C. decided to marry Nanny's illegitimate daughter, Princess Escoc Miller, his father gave him a piece of land to farm and tolerated his choice of bride. My given name derives from Cary with a slight change of spelling that my mother thought practical so as to keep my initialed name from being the same as my Dad's, C.B. Mullis. She probably never imagined that I would be living far away before it ever mattered.

The rest of my life has passed quite suddenly. Around ten or twelve I fell into the inevitable logarithms of time. It seems to go faster and faster. I wonder now why we have to have Christmas so often.

I went to high school in Columbia. I met my first wife, Richards, whom I married while I was working on a B.S. in chemistry at Georgia Tech. She bore Louise and I studied. I learned most of the useful technical things, math, physics, chemistry, that I now use, during those four years. I did little else, except to play with Louise and change her diapers at night. We moved to Berkeley, California in 1966. I did my Ph.D. in biochemistry under J.B. Neilands and there I learned the rest, the non-technical things. After that, it happened so quickly that it's hard to really talk about in the wake of my grandparents' farm.

Except for Cynthia and our boys.

I met Cynthia while I was in Kansas for three years. She's the very special daughter of an old grain trading family and a pathologist, David Gibson. Cynthia encouraged me to write and brought Christopher and Jeremy into the world. I left her, some say foolishly, when we were living in California in about 1981.

I was working for Cetus, making oligonucleotides. They were heady times. Biotechnology was in flower and one spring night while the California buckeyes were also in flower I came across the polymerase chain reaction. I was driving with Jennifer Barnett to a cabin I had been building in northern California. She and I had worked and lived together for two years. She was an inspiration to me during that time as only a woman with brains, in the bloom of her womanhood, can be. That morning she had no idea what had just happened. I had an inkling. It was the first day of the rest of my life.

From there it's a single sentence. I worked as a consultant, got the Nobel Prize, and have now turned to writing. It is 1994.

From [Les Prix Nobel](#). *The Nobel Prizes 1993*, Editor Tore Frängsmyr, [Nobel Foundation], Stockholm, 1994

This autobiography/biography was written at the time of the award and later published in the book series [Les Prix Nobel/ Nobel Lectures/The Nobel Prizes](#). The information is sometimes updated with an addendum submitted by the Laureate.

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## Addendum, August 1999

And then early in the spring of 1997 there was Nancy and my whole heart began to unfold and everything else before seemed like a long dream from which I had awakened at last. Married: Nancy Lier Cosgrove, San Francisco, CA March 21, 1998.

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## Addendum, April 2005

One of the nice things about being honored with a Nobel Prize is that it is a ticket into any office once. There's almost no one you might want to see who refuses to see you



just once on the basis of your Stockholm credentials alone. After that you're on your own. People also invite you to visit their campus or meeting, and talk. I warm to a microphone and a crowd. I like to travel, so Nancy and I have been able to see the world, and there's always someone there to meet us at the airport and take care of us in their hometown. What a deal. I get tired of talking about the polymerase chain reaction, but I read a lot, and think a lot, and I can talk about almost anything. Being a Nobel laureate is a license to be an expert in lots of things as long as you do your homework.

In the last two years, my long travel holiday has fallen partial victim to an idea I started thinking about several years ago and lately started working on for real. It is a method using specific synthetic chemical linkers to divert an immune response from its nominal target to something completely different which you would right now like to be temporarily immune to. Let's say you just got exposed to a new strain of the flu. You're already immune to alpha-1,3-galactosyl-galactose bonds. All humans are. Why not divert a fraction of those antibodies to the influenza strain you just picked up. A chemical linker synthesized with an alpha-1,3-gal-gal bond on one end and a DNA aptamer devised to bind specifically to the strain of influenza you have on the other end, will link anti-alpha-Gal antibodies to the influenza virus and presto, you have fooled your immune system into attacking the new virus.

DARPA officials let me into their offices one time with this idea and before long I was a practicing immunologist. It's not too far from being a synthetic DNA chemist if you don't mind reading a strange new language for awhile. The concept is actually working now with rodents and their diseases. Hopefully it's going to work in humans. I've started a little company called Altermune to coordinate the work, which is happening in several research labs, whose directors made the fatal mistake of letting me into their offices once. It is an interdisciplinary project, requiring chemists, immunologists and infective disease people. It also gives me something exciting and new to talk about when I take time off and indulge my old habit of traveling and talking.

For more biographical information, see: Mullis, Kary, *Dancing Naked in the Mind Field*. Pantheon Books, New York, 1998.

*Kary B. Mullis died on 7 August 2019.*

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