

# Katalin Kariko, scientific maverick who paved way for mRNA vaccines

October 2 2023, by Issam AHMED

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Katalin Kariko spent much of the 1990s writing grant applications to fund her investigations into 'messenger ribonucleic acid' -- genetic molecules that tell cells what proteins to make, essential to keeping our bodies alive and healthy.

Hungarian-born scientist Katalin Kariko's obsession with researching a substance called mRNA to fight disease once cost her a faculty position at a prestigious US university, which dismissed the idea as a dead end.

Now, her pioneering work—which paved the way for the Pfizer/BioNTech and Moderna COVID-19 vaccines—[has won her the Nobel Prize in Medicine](#).

Kariko, 68, spent much of the 1990s writing grant applications to fund her research into "messenger [ribonucleic acid](#)"—genetic molecules that tell cells what proteins to make, essential to keeping our bodies alive and healthy.

She believed mRNA held the key to treating diseases where having more of the right kind of protein can help—like repairing the brain after a stroke.

But the University of Pennsylvania, where Kariko was on track for a professorship, decided to pull the plug after the grant rejections piled up.

"I was up for promotion, and then they just demoted me and expected that I would walk out the door," she told AFP in an interview from her home in Philadelphia in December 2020.

Kariko didn't yet have a green card and needed a job to renew her visa. She also knew she wouldn't be able to put her daughter through college without the hefty staff discount.

She decided to persist as a lower-rung researcher, scraping by on a meager salary.

It was a low point in her life and career, but "I just thought...you know, the (lab) bench is here, I just have to do better experiments," she said.

The determination runs in the family—her daughter Susan Francia did go to UPenn, where she earned a master's degree, and won gold medals with the US Olympic rowing team in 2008 and 2012.

## **Twin breakthroughs**

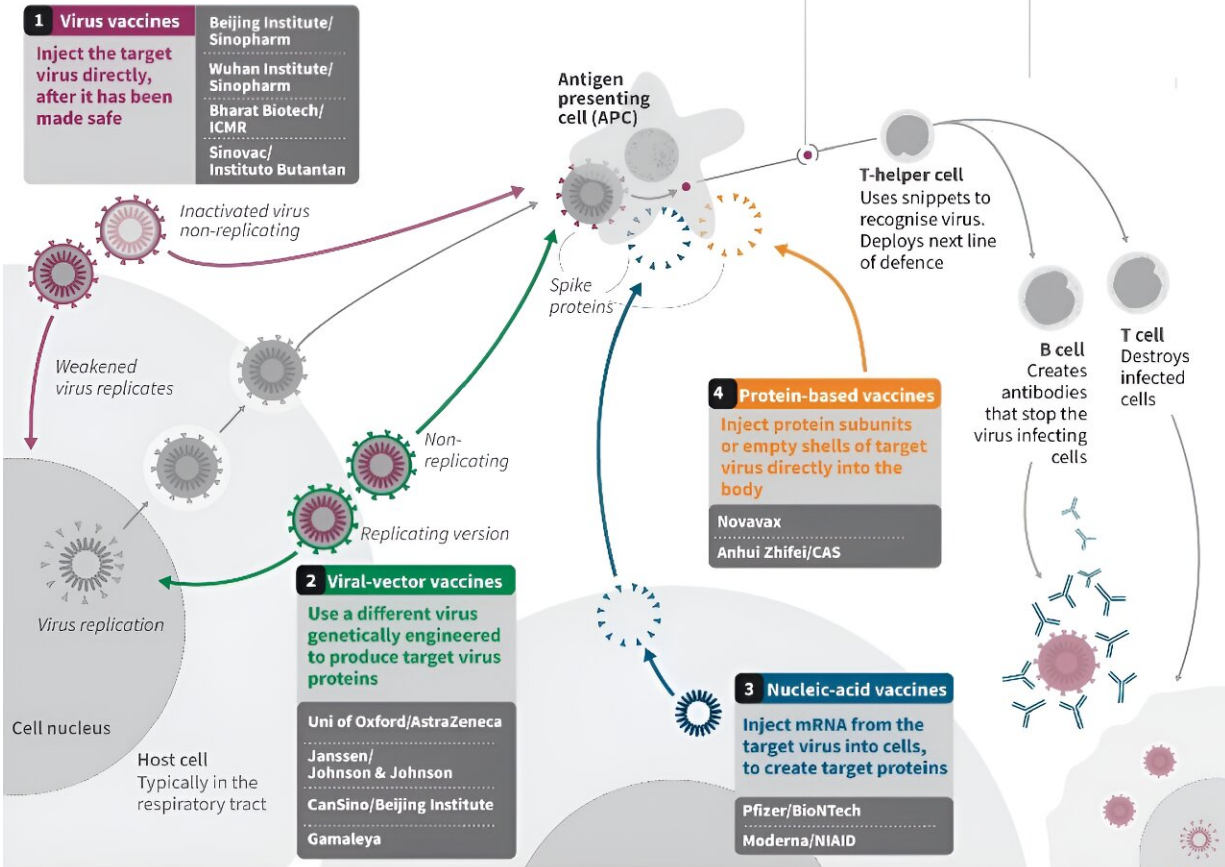
By the late 1980s, much of the [scientific community](#) was focused on using DNA to deliver [gene therapy](#), but Kariko believed that mRNA was also promising since most diseases are not hereditary and don't need solutions that permanently alter our genetics.

## Different routes to a Covid-19 vaccine

Leading contenders in the race to establish effective inoculation against the SARS-CoV-2 virus

### How they work

- ▶ Vaccines are all designed to safely trigger the body's natural immune response to SARS-CoV-2
- ▶ There are four main approaches towards developing a vaccine against the virus
- ▶ All methods rely on APC to initiate the immune response
- ▶ APC identifies peptides, snippets of virus protein
- ▶ Immune cells will then be enabled to recognise and neutralise the virus



Source: Vaccine pipeline/Nature journal

AFP

Different routes to a COVID-19 vaccine.

First though, she had to overcome a major problem: in animal experiments, synthetic mRNA was causing a massive inflammatory response as the [immune system](#) sensed an invader and rushed to fight it.

Kariko, together with her main collaborator and co-winner Drew Weissman, discovered that one of the four building blocks of the

synthetic mRNA was at fault—and they could overcome the problem by swapping it out with a modified version.

They published a paper on the breakthrough in 2005. Then, in 2015, they found a new way to deliver mRNA into mice, using a fatty coating called "lipid nanoparticles" that prevent the mRNA from degrading, and help place it inside the right part of cells.

Both these innovations were key to the COVID-19 vaccines developed by Pfizer and its German partner BioNTech, where Kariko is now a [senior vice president](#), as well as the shots produced by Moderna.

Both work by giving [human cells](#) the instructions to make a surface protein of the coronavirus, which simulates an infection and trains the immune system for when it encounters the real virus.

## **New treatments**

Though she does not want to make too much of it, as a foreign-born woman in a male-dominated field, Kariko occasionally felt underestimated—saying people would approach after lectures and ask "Who's your supervisor?"

"They were always thinking, 'That woman with the accent, there must be somebody behind her who is smarter or something,'" she said.

Yet the Nobel is just the latest accolade for Kariko, who has won the Breakthrough Prize, the L'Oreal-UNESCO prize for women in science awards, among many others.

It is a far cry from the time when her late mother would call every year after prize announcements to ask why she hadn't been chosen.

"I never in my life get (federal) grants, I am nobody, not even faculty," she would reply with a laugh.

To which her mother would reply: "But you work so hard!"

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Citation: Katalin Kariko, scientific maverick who paved way for mRNA vaccines (2023, October 2) retrieved 28 April 2024 from <https://medicalxpress.com/news/2023-10-katalin-kariko-scientific-maverick-paved.html>

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