

TOI + A SHOT OF HOPE

Not just Covid, mRNA vaccines could cure cancer in a few years

Covid Was Only The First Step — More Than 150 mRNA Vaccines Are Now Being Developed For Diseases Ranging From The Flu To HIV

Abhilash.Gaur@timesgroup.com

When governments, universities and investors gave up on mRNA technology years ago, Katalin Kariko hung on. The biochemist, who moved from Hungary to the US in the 1980s, has done more to prove mRNA's worth than anyone else. She told Stephen Buranyi of Wired in March she had always believed mRNA could fix anything, "whatever it was, a disease, baldness even."

The Covid pandemic gave Kariko and other mRNA believers the first opportunity to demonstrate its powers to the public. Chinese scientists published the Covid virus's genetic sequence on January 11, 2020, and "Moderna's mRNA vaccine recipe was finalised in about 48 hours," Derek Thompson writes in The Atlantic. By late-February, it was ready for clinical trials.

The new technology was not only lightning fast but also incredibly effective — mRNA Covid vaccines from both Moderna and Pfizer hit the bull's-eye in terms of efficacy. But what's the future of this technology, will it be used to fight other diseases after the pandemic?

The next mRNA miracle might be closer than you imagine. More than 150 new mRNA vaccines and therapies are being developed, says Buranyi. BioNTech, which developed Pfizer's coronavirus vaccine, has seven in the pipeline; Moderna has nine.

Body's Code Language

Speed aside, why is mRNA technology so effective? Thompson says it's because it uses the human body's enormous capability to make new proteins: "just about any protein under the sun."

There's a protein for every bodily function, and your body makes trillions of them every day. If you could somehow tell it to make a specific protein to beat a virus, or cure a disease, it would do so on its own. mRNA or 'messenger ribonucleic acid' made in the lab makes it possible to send instructions to the protein factory in our cells.

Fighting The Big C

Cancer is no longer an incurable disease but it's still damaging and dreadful. However, the protein-

factory approach of mRNA vaccines could eventually defeat it. In a recent National Geographic article, Stacey Colino writes some of the mRNA vaccines for “melanoma, non-small cell lung cancers, gastrointestinal cancer, breast cancer, ovarian cancer, and pancreatic cancer, among others” are now readying for clinical trials.

While most vaccines are preventive — they protect you from future infections — those for cancer are mostly “therapeutic”, Colino says. They are given after the onset of disease, but are not “drugs” as they work by goading the immune system into a fight.

She mentions Molly Cassidy, a late-stage head and neck cancer patient who had planned her funeral before she was drafted into an mRNA cancer vaccine trial at the University of Arizona Cancer Center last year. She took nine shots over 27 weeks. “By the time the treatment concluded in October 2020, Cassidy’s CT scans were clean: There was no evidence of cancer in her body.”

Colino says results from animal and human studies of mRNA cancer vaccines have been promising, and “eventually vaccines could be developed to treat certain cancers, prevent recurrences, and possibly even prevent some cancers in those who are genetically predisposed to them.”

Ending A Century Of Flu

The Spanish flu of 1918 was the last great pandemic before Covid, and the flu in its many guises still kills about 300,000 people every year. There are vaccines for it, but their results are iffy because flu viruses are a moving target. They mutate so fast, by the time you get a vaccine out it might not be effective. Flu shots released in 2018-19 were just 29% effective, says Buranyi, “some years it is as low as 10%.”

But if you could design a vaccine in 48 hours after the virus is sequenced, and have it in clinics inside a month, it would change the flu game. BioNTech is one of the six companies working on an mRNA flu shot, and its CEO Ugur Sahin says they expect to start human trials later this year.

Towards Eternal Youth

Dozens of other mRNA “work orders” for the body’s protein factory are also in the pipeline. Malaria, for example, is a priority target. It kills more than 400,000 people every year, making mosquitoes the “deadliest animal” on the planet. There’s a vaccine for it, but it “doesn’t work very well, even after a four-shot regimen,” says Thompson. But in February, Yale scientists patented an RNA-based vaccine for malaria that has shown good results in mice, he adds.

Buranyi says mRNA vaccines for Nipah, Zika, herpes, dengue, and hepatitis have been announced while at least six are being developed for HIV, even though it is very hard to target because “it mutates unbelievably quickly, often creating multiple variants inside a single patient.”

Kariko, meanwhile, has set her sights on something bigger. “She is excited about a laboratory that is using mRNA to try and extend human telomeres,” says Buranyi. Telomeres are DNA caps at the end of chromosomes, and longer telomeres are associated with slower ageing. Someday, maybe mRNA will unlock the fountain of eternal youth.



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PRE-EMPTIVE STRIKE: In 2013, actor Angelina Jolie got both her breasts removed as she carries a faulty BRCA1 gene that increases the risk of breast cancer. mRNA vaccines for cancer will spare people such difficult choices