COVID-19 Vaccine's mRNA Technology Could One Day Help Treat Cancer

Vaccines that stimulate immune responses against cancer using the mRNA technology may be fast-acting and cheap to make.

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The medical technology behind the Pfizer/BioNTech and Moderna/National Institutes of Health (NIH) vaccines—which received emergency use authorization from the Food and Drug (FDA) on December 11 and December 18, respectively—could have significant applications for cancer treatment as well, reports Bloomberg.

Both COVID-19 vaccines employ a novel messenger RNA (mRNA) approach. That means they use lipid nanoparticles, or fat bubbles, to deliver bits of genetic material that encode instructions for making the SARS-CoV-2 spike protein, which the new coronavirus uses to enter human cells. When injected into a muscle, the cells produce the protein, triggering an immune response. The mRNA degrades quickly in the body and does not alter human genes.

But mRNA technology was originally developed for use in cancer vaccines. These experimental cancer vaccines use mRNA to stimulate cells to produce specific tumor-associated proteins, triggering an immune response against the cancer. Both Moderna and BioNTech, Pfizer's German partner, recognized the technique's potential and began investigating its applications to cancer treatment years ago.

Because it is fragile and prone to breakdown by enzymes in the body, mRNA is difficult to work with in laboratory settings. Encapsulating the molecule in fat globules helped solve that problem.

Moderna and BioNTech are currently conducting clinical trials of therapies that use mRNA technology to treat cancer. The preliminary results are promising. One BioNTech cancer vaccine shrank tumors in people with advanced melanoma. A Moderna cancer vaccine, used in combination with Merck's checkpoint inhibitor Keytruda (pembrolizumab), shrank tumors in 50% of people with advanced head and neck cancer.

The technology is fast-acting and relatively cheap to produce, and its success at preventing COVID-19 might be the final push biomedicine needs to embrace it fully. "We are now entering the age of mRNA therapeutics," Derrick Rossi, a stem cell biologist and cofounder of Moderna, told Bloomberg. BioNTech's CEO, Uğur Şahin, predicts that the first mRNA cancer vaccines could be

available within several years.

Besides cancer and COVID-19, mRNA technology could also be used to prevent the seasonal flu and treat heart failure, cystic fibrosis, sickle cell anemia, cytomegalovirus and HIV, among other diseases. Its medical possibilities, in short, are many.

To learn more about mRNA technology, "Understanding and Explaining mRNA COVID-19 Vaccines." To learn about the novel use of vaccines to treat cancer, see "A Shot at a Cure."

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