mRNA Vaccines, Simplified

A crisis of staggering proportions can sometimes prove useful as a breeding ground for technological and medicinal advancements. Polio, once a blight that adversely impacted the lives of approximately 119,000 people between 1900 and 1950 (https://www.chop.edu/news/feature-article-flashback-parenting-and-summer-1950s) is now virtually non-existent in the industrial world, all thanks to Jonas Salk's groundbreaking polio vaccine. The recent release of widely-available vaccines created with mRNA technology may very well be this generation's answer to the breakthrough Salk made over 60 years ago.

But what is mRNA? To provide a simplified answer, we must first discuss the most prominent methods of vaccine production which predate mRNA.

First there are attenuated vaccines. These vaccines are made from a sample of the virus that has been bred to be uninfectious so that your immune system can get a sense of the virus' characteristics, in the event of exposure to the virus at full potency.

Next comes inactivated vaccines. Inactivated vaccines contain a previously-infectious sample of the offending virus that has been stripped of its virulence by exposure to chemicals, heat, or radiation. Most flu shots are made this way, as was Salk's original vaccine.

Behind that comes toxoid vaccines. These are vaccines created to combat toxins as opposed to viruses and pathogens. Toxoid vaccines are used to treat diphtheria and tetanus, as both conditions are caused by exposure to certain harmful bacterias, while the previously-described varieties of vaccine are aimed at viral illnesses.

mRNA vaccines now stand at the front of the line. Their advantage? They contain neither an inactivated virus nor a replica of an infectious agent, both of whose cultivation is time-consuming and expensive. mRNA technology allows for scientists to create vaccines containing synthesized RNA (RiboNucleic Acid). RNA is essential to human and animal life, in that it links our DNA with ribosomes, the cellular components which carry out protein synthesis: the processes by which your body comes to grow, adapt, and manifest certain genes like hair color or height. (https://www.nature.com/scitable/topicpage/ribosomes-transcription-and-translation-14120660/)

mRNA vaccines contain a synthesized piece of RNA which mimics the protein that offending viruses use to attach to your cells and multiply. Suspended in lipids (fats) which protect the mRNA during its voyage through your body, and allow it to make contact with your cells, the two will come into contact and trigger the production of immune-building cells aimed at combating that particular virus (https://biontech.de/covid-19-portal/mrna-vaccines#:~:text=How%20are%20mRNA%20vaccines%20manufactured,synthesize%20specific%20proteins%20(antigens).

mRNA has great clinical potential beyond just virology. In fact, before the advent of Covid-19, mRNA vaccine technology was being investigated as a potential treatment for colorectal cancer, formulated to combat the unique characteristics of a patient's cancerous tissues. In the case of colorectal cancer, an mRNA vaccine would be created in the aftermath of surgery and/or chemotherapy, with the aim of preventing circulating cancer DNA from taking root again. While not curative on its own, at least at present, it can, nonetheless, prevent the recurrence of cancers noted for high volumes of recurrence linked to residual cancer DNA (https://www.mdanderson.org/cancerwise/can-mrna-vaccines-like-those-used-for-covid-19-be-used-in-cancer-care.h00-159457689.html).

We are, without question, witnessing an historic event. A fresh, multitudinous division of medicine is beginning to take root, and we are already seeing its benefits and potential. mRNA vaccines and other similarly-derived treatments may be able to cure or control diseases on an individual basis, with its user-tailored directive allowing for all strengths and specificities to be offered up to those in need.

Sources Cited

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