2024 Superconvergence biorevolution series: Journey to the mRNA vaccine & beyond

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Key Takeaways

- mRNA and DNA are simply examples of how the body chemically stores important information, and our ability to process and store information has been increasing exponentially. An mRNA vaccine, for example, can be thought of as a set of instructions we seek to insert into cells to allow them to fight off an infectious agent
- mRNA vaccines were massive during the COVID-19 pandemic, but it's important to recognise that mRNA is really just a platform, and we can use the capability to insert instructions into cells for many different types of things
- The idea of vaccines that instruct the immune system to attack cancer cells and not healthy cells is a very interesting line of research that could one day obviate the need for certain kinds of chemotherapy

When constructing our Biorevolution strategy, we worked alongside futurist Dr Jamie Metzl, who is a member of the World Health Organization's expert committee on human genome editing. We believe that we are on the precipice of a remarkable period, which could last a few decades, where we challenge and ultimately evolve how we do things, such as:

- How we handle human health care
- How we grow food for an expanding global population
- How we generate novel materials, chemicals and energy from biological sources
- How we think about storing massive amounts of data with higher density and fidelity than we have in the past

The bottom line

Thematic investing, in a sense, is about storytelling. Superconvergence does a great job conveying the narrative behind the WisdomTree BioRevolution ESG Screened Index.

A vaccine revolution

Many people may not realise it, but we depend largely on eggs as 'mini manufacturing units' to synthesise the influenza vaccine. This process allows us to create weakened influenza virus particles for the vaccine,

which allows the human immune system to be better prepared to respond strongly to the real thing during flu season[1].

However, this is not the only way to synthesise vaccines. From Superconvergence[2]:

Things get more interesting when we see how different technologies that have been undergoing decades of development converge. The mRNA vaccine story—which is ongoing—is an excellent example of this:

- Through the work done on the Human Genome Project, we learned how to better sequence DNA data from different organisms in different ways. This was an important foundation.
- At the same time, we can recognise that DNA and RNA represent different sequences of chemical instructions at their core. Processing power has steadily increased through such principles as 'Moore's Law', and we have also seen speed-ups in data transmission and increasing ease of data storage.
- Cloud computing infrastructure has been built such that those with the appropriate resources and needs can instantly spool up powerful computing platforms on demand to accomplish specific tasks.
- AI algorithms and machine learning capabilities can recognise patterns in almost any kind of data.

Within two days of receiving the computer file of the sequenced genome, they had come up with the recipe for what became the Moderna vaccine, which incorporated the innovations of decades of research and the work of multiple scientists, particularly from the NIH and the Universities of Texas and Pennsylvania. Not a single wet-lab experiment was involved.

Two months later, the first human trial began. Nine months after that, the first vaccine dose was administered under an emergency use approval by the US Food and Drug Administration (FDA). As of 2024, around 12 billion COVID-19 vaccine doses had been administered to people across the globe, a large percentage of those using mRNA vaccines.

By the time later variants of the SARS-CoV-2 virus, like the infamous Omicron, caused COVID-19 infections to spike worldwide in late 2021 and early 2022, developing variant-specific boosters had become even faster. The mRNA vaccines had increasingly become "plug and play." Companies like Moderna and Pfizer/BioNTech rapidly developed single-dose mRNA vaccine boosters that targeted the early Omicron variant known as BA1, which performed well in human clinical trials.

The bottom line is that the foundation was there, and multiple technologies were ready to respond as scientists and researchers sought to have as fast a solution as possible to help the world 're-open' during the COVID-19 pandemic.

mRNA's story doesn't end with COVID-19

Moderna was the company embodiment of the mRNA story. Its 'COVID jab' generated more than $40 billion in revenue. The company, at one point, had a market capitalisation of $160 billion[4].

However, Moderna has an issue—how can it convince market participants that mRNA is a far broader platform for fighting different diseases than simply being a solution for COVID-19?

Superconvergence noted some of the possibilities[5]:

The mRNA vaccines weren't just a new approach to vaccination but a new platform for delivering alternate sets of instructions to our bodies. Active trials are now underway using similar mRNA delivery platforms to treat cancer, HIV, malaria, tuberculosis, Alzheimer's disease, herpes, respiratory syncytial virus (RSV), inherited metabolic disorders, cystic fibrosis, multiple sclerosis, heart disease, and asthma.

The human immune system is a fascinating set of different capabilities. It is imbued with a capacity to recognise foreign cells and develop a response that, in most cases, repels what could otherwise be a severe infection.

What if you could instruct this system to do different things on demand?

There is a use case in patients with melanoma. Doctors are able to get the requisite sample from cancer cells that can then be used, through a set of mRNA instructions, to train a person's individual immune system to attack that person's specific cancer cells. These cells have certain characteristics, just like the so-called 'spike-protein' in the COVID-19 virus .[6]

The notable element is that if the immune system only attacks cancerous cells, this treatment is a stepwise improvement over chemotherapy, which affects many different cells. While it is not yet widely used, there are signs that this type of therapy could have a very promising future.

Source

[1] https://www.cdc.gov/flu/prevent/cell-based.htm#:~:text=Most%20inactivated%20flu%20vaccines%20are,instead%20of%20in%20hen's%20eggs.

[2] Metzl, Jamie. Superconvergence: How the Genetics, Biotech, and AI Revolutions will Transform our Lives, Work and World. Timber Press: 2024.

[3] Metzl, 2024.

[4] Barnes, Oliver. "Moderna wins second approval with vaccine targeting RSV infection." Financial Times. May 31, 2024.

[5] Metzl, 2024.

[6] Dolgin, Elie. "How Customized RNA Vaccines Might Halt Cancer." Nature. Vol 630. June 13, 2024.

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