Delivering on the promise of cell and gene therapy for patients [1]

The term “personalized medicine” captures the imagination. As unique individuals, we gravitate toward the idea of treatment that’s tailored to the patient. Cell and gene therapy represents a major leap in personalized medicine, creating an inflection point in our ability to treat and potentially even cure many intractable illnesses.

Each cell and gene therapy is designed based on detailed information about the roots of a patient’s disease. It treats a condition at its source, repairing or enhancing cells at the genetic level. At Novartis, we’re collaborating on the cell and gene therapy frontier to bring this revolutionary approach to patients with a variety of diseases, including genetic disorders and certain deadly cancers.

Cell and gene therapies are designed to halt a disease in its tracks or reverse its progress rather than simply manage symptoms. These are often one-time treatments that may alleviate the underlying cause of a disease, and they have the potential to cure certain conditions. In contrast, many conventional medicines must be taken on a continual basis for weeks or months, or even for life.

Cell and gene therapies are grounded in careful research that builds on decades of scientific progress. The core tools and technologies have been tested and refined by countless experts, first in the lab and later in the clinic. With cell therapy, cells are cultivated or modified outside the body before being injected into the patient, where they become a “living drug.” With gene therapy, genes are replaced, inactivated or introduced into cells – either outside or inside the body – to treat a disease. Some treatments qualify as both cell and gene therapy.

And all of these treatments qualify as personalized medicine, a term that was popularized

when scientists first determined the DNA sequence of the entire human genome. At the time, researchers dreamed of leveraging information about the unique genetic makeup of individuals to tailor treatment for patients and fundamentally change medicine. Cell and gene technology brings us closer to this ambitious goal.

Innovation in action

This is a pivotal time for innovation in the field. Following key approvals of cell and gene therapies by health authorities, new treatments are being tested in clinical trials around the world. Novartis has a consistent history of working and investing to drive the research and development of such therapies forward. Kymriah® – the first gene therapy approved in the US – was the culmination of a multiyear collaboration with the University of Pennsylvania. It employs chimeric antigen receptor T-cell (CAR-T) technology.

Kymriah® has the ability to reprogram a patient's own immune cells to recognize and fight cancers, including certain types of acute lymphoblastic leukemia (ALL) and B-cell lymphoma.[1] The reprogrammed immune cells are returned to the patient in an infusion and are ready to begin detecting and destroying cancer cells. Initially, patients who receive the one-time treatment often experience serious side effects, which are frequently severe enough to require hospitalization. While not all Kymriah® recipients have a positive outcome, many patients then begin to feel healthy. Some of the first patients to receive the treatment – which is now available in more than 20 countries – have shown no signs of relapse for more than five years. The team is now working to design and test new CAR-T therapies for a variety of difficult-to-treat cancers.

We are also developing cell and gene therapies to address genetic conditions, especially diseases caused by the mutation of a single gene. Initially, Novartis is focusing on conditions of the central nervous system, the eye and the blood because we have deep expertise in these areas and because it's currently possible to deliver genetic material to these locations. In other words, we can get the cell or gene therapy to the relevant tissue. Novartis teams may expand into additional therapeutic areas in the future.

Our flagship gene therapy in neuroscience is Zolgensma®, which was first approved in May 2019 in the US to treat children less than 2 years old with spinal muscular atrophy (SMA).[2] Zolgensma® is given as a one-time infusion into the vein. SMA is a rare and devastating genetic disease that leads to progressive muscle weakness and, in some cases, paralysis or death. Without a functional survival motor neuron 1 (SMN1) gene, infants with one of the most severe forms of the disease – called SMA type 1 – rapidly lose the motor neurons responsible for muscle functions such as breathing, swallowing, speaking and walking. It is imperative to diagnose SMA and begin treatment as early as possible to halt irreversible motor neuron loss and disease progression.

Our transformative treatment is designed to address the root cause of the disease: a mutation in the SMN1 gene. Zolgensma® works by replacing the missing or defective SMN1 gene with a functional copy that makes SMN protein, thereby halting disease progression. We are working to bring the treatment to additional countries and are exploring new applications for the underlying technology, a powerful gene therapy platform that may be relevant to other devastating diseases such as Rett syndrome, a genetic form of amyotrophic lateral sclerosis (ALS), and Friedreich's ataxia.

Novartis programs in ophthalmology and hematology are also focused on transforming patient care. For example, Novartis has global rights outside the US to Luxturna®, a gene therapy designed by Spark Therapeutics. It has the potential to restore sight in children and adults with a rare, progressive genetic condition that leads to total blindness. Luxturna® is currently available across multiple countries in Europe and the Middle East for the treatment of adult and pediatric patients with vision loss due to inherited retinal dystrophy caused by a genetic mutation in both copies of the RPE65 gene. Patients must also have enough viable retinal cells to receive the therapy. We believe we have the expertise, scale and commitment to successfully commercialize such novel treatments in a variety of regions. We're exploring innovative approaches to provide access for patients.

Collaborating on a new frontier

While we are reimagining medicine, current healthcare systems are designed to actively manage chronic conditions, where treatment and therapies occur on a regular basis, sometimes over many years or even decades. They are not set up for therapies that are designed to work for a lifetime following a single infusion. One-time cell and gene therapies deliver benefits to patients, healthcare systems and society. They also introduce a number of unprecedented complexities in diagnosis, treatment, care and payment while potentially saving money for the system as a whole. We are collaborating with governments, hospitals, doctors and insurance companies to find solutions, including by exploring new payment models and rethinking current healthcare coverage. Cell and gene therapy offers an opportunity for the entire industry to revisit the way that medicine is brought to patients.

All of these efforts complement our conventional drug discovery and development programs. Our work with small molecules and biological molecules – therapeutic staples – continues. We also hunt for new ways to treat diseases, including by exploring cell and gene therapies.

Novartis has made one of the largest investments in cell and gene therapy in the industry. We are building on the momentum of recent approvals from health authorities, with more than a dozen projects in clinical development and additional research underway. We believe in the promise of these exciting new medicines and will continue to work to advance them for patients.

Work with us

To learn about opportunities to join our team, visit our Careers section [2]

Disclaimer:

References:

1. Kymriah® is now available in more than 20 countries for certain pediatric and young adult patients with B-cell ALL that is refractory (the disease did not go into remission with other leukemia treatments) or in second or greater relapse (the disease went into remission and then came back). Kymriah® is also approved in these countries for a particular type of relapsed or refractory large B-cell lymphoma in adult patients.
2. Zolgensma® is an adeno-associated virus vector-based gene therapy indicated for the treatment of pediatric patients less than 2 years of age with spinal muscular atrophy (SMA) with bi-allelic mutations in the survival motor neuron 1 (SMN1) gene.

Footnotes:

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Links
[1] https://www.novartis.com/our-focus/cell-and-gene-therapy/delivering-promise-cell-and-gene-therapy-patients
[2] https://www.novartis.com/careers/career-search#division=NIBR