Pioneering Breakthroughs that Change Patients' Lives

Our End-to-End Gene Therapy Capabilities

There are

7,000+

KNOWN RARE DISEASES WORLDWIDE

4 out of 5 or

80%

ARE GENETIC IN ORIGIN.[1]

Gene therapy represents the **next wave of treatment innovation** and holds tremendous promise for patients living with rare genetic diseases.

By targeting a single genetic alteration, gene therapy has the potential to restore normal function – possibly ***with just one treatment*** – and change the way patients' manage their disease.[ii,iii]

Genes as Medicine

Gene therapy is a new generation of medicine where a functioning gene is delivered to a targeted tissue in the body to produce a missing or non-functional protein. **By using genes as medicine,** we can target the underlying cause of a disease at the cellular level.[ii,iii]

Developing Innovative Breakthroughs

We are developing highly specialized treatments that use custom-made **recombinant adeno-associated virus (rAAV) vectors** to deliver gene therapy directly to targeted cells. Currently, we are focusing on diseases caused by a single-gene alteration.

When the vector reaches the targeted cell, the functioning gene is transferred and used as a blueprint to produce the missing or non-functioning protein.[ii]

Our rAAV gene therapy platform can be standardized, potentially streamlining the manufacturing and regulatory path to medicine approval.[iv]

Our End-to-End Capabilities

Our passion continually drives us to **deliver breakthroughs in patients' lives,** today and every day.

To do this, we've made investments in innovative gene therapy technology and facilities over the past several years – giving us end-to-end capabilities and the ability to guide a gene therapy medicine through its entire life cycle. [iv]

"Strategic investments in partnerships to build our own manufacturing facilities, paired with our 30 year heritage in rare disease, have positioned us well to deliver breakthrough therapies that change patients' lives."

Bob Smith,
Senior Vice President, Global Gene Therapy Business

Pfizer Rare Disease

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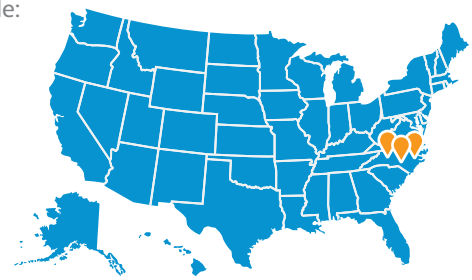
Our Investment

Our investments to enable gene therapy discovery, development, and manufacturing include:

- A research scale and GLP (Good Laboratory Practice) grade facility in Kit Creek, North Carolina
- A clinical scale and GMP (Good Manufacturing Practice) grade facility in Chapel Hill, North Carolina
- Recently completed construction and ongoing expansion of a state-of-the-art, commercial scale, gene therapy-focused manufacturing complex in Sanford, North Carolina



Manufacturing Gene Therapies: The Four Steps

There are **four steps** to the manufacturing process, where we transform viruses into potential gene therapies.[iv]

Step 1: Raw Material Preparation

A gene therapy vector consists of three parts – the vector genome, AAV protein, and helper proteins – to ensure the AAV functions optimally. In the first step of the process, we secure and combine these components to manufacture the shell, called a capsid, which houses the functioning gene that will be delivered to the affected tissue. [iv]

Step 2: Upstream Processes

Next, the newly created capsids are encapsulated into the viral vector. HEK cells are used to produce the capsids and package the functioning gene to create the vector. [iv]

Step 3: Downstream Processes

This is the purification stage, where the non-essential cellular matter is removed from the vector. Next, the vector is reviewed to ensure it is working properly and measured to confirm there is an appropriate volume of the therapy to provide an effective treatment. [iv]

Step 4: Product Completion & Packaging

The final step is to package the gene therapy for clinical or commercial use. [iv]

While the total amount of time needed to develop gene therapies depends on the targeted disease and the impacted body tissue, it generally takes 9-10 months from start-to-finish. [iv]

Our clinical development portfolio includes programs for hemophilia A, hemophilia B, and Duchenne muscular dystrophy (DMD). At the same time, we're committed to building a robust pipeline through preclinical research investigating potential treatments for endocrine/metabolic disorders, such as Wilson Disease, and neurologic disorders, such as Friedreich's Ataxia, Dravet Syndrome, and amyotrophic lateral sclerosis (ALS). [iv]

At Pfizer, we're **proud** of the work we're doing to advance this exciting science. We remain committed to discovering, researching, developing, and expanding our end-to-end gene therapy capabilities to potentially deliver breakthroughs that change patients' lives.

i. Global Genes. Rare disease: facts and statistics. https://globalgenes.org/rare-diseases-factsstatistics/. Accessed July 31, 2019.

ii. Genetics Home Reference (GHR). How does gene therapy work? https://ghr.nlm.nih.gov/primer/therapy/procedures. Jul 16, 2019. Accessed July 31, 2019.

iii. Genetics Home Reference (GHR). What is gene therapy? https://ghr.nlm.nih.gov/primer/therapy/genetherapy. Jul 16, 2019. Accessed July 31, 2019.

iv. Data on file. Pfizer Inc., New York, NY

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