7 Biotechs Fighting Rare Diseases With Gene-Editing Tech

March 1, 2021 by Alexander Korolyov

As of now, only 5% of so-called rare diseases (orphan diseases) have an FDA-approved treatment available to patients. Rare diseases are defined as those affecting fewer than 1 in 200000 people with almost 80% of all rare diseases being of genetic nature. while only

With recent progress in gene-editing technologies, including breakthroughs like CRISPR/Cas9 and new therapy delivery technologies, there is a wave of innovative biotech companies entering the field of rare diseases equipped with new ways to address the problem.

In this article, I would like to outline a list of notable companies targeting rare diseases with cutting-edge gene therapies.

Generation Bio

Generation Bio is known for its platform consisting of proprietary non-viral closed-ended DNA (ceDNA) construct and cell-targeted lipid nanoparticle (ctLNP) delivery system. It provides three times higher capacity of viral capsids and the ability to carry larger and possibly multiple gene material without activation of the immune system. The company's current pipeline addresses liver and retina-related pathologies with future potential in oncology, skeletal muscles, and CNS diseases. Generation Bio's lead therapies for Phenylketonuria (PKU) and Hemophilia A are at the pre-clinical development stage.

Founded in 2016, the company raised a $110 million Series C in 2020 led by T. Rowe Price. This transaction brought the company's total capital up to $235 million and brought together some prominent investors, including Fidelity Management and Research Company, and Atlas Venture. The company went public in Jun 2020 raising $200 million..

DiNAQOR

DiNAQOR, a Swiss biotech startup founded in 2019, develops a novel gene therapy platform consisting of modified adeno-associated vectors (AAV) together with a specific loco-regional delivery system. Their innovation is in utilizing AAV serotypes with increased specificity towards cardiac tissues together with cardiac-specific promoters which improve gene expression in the heart tissues. This could potentially lower the toxicity issues which often accompany the gene-therapy approach. The current lead therapy DINA-001 against monogenic cardiomyopathy is in the preclinical stage.

Taysha Gene Therapies

Taysha Gene Therapies was founded in January 2020 in Dallas, and it has an ambitious goal for direct delivery of gene therapy into spinal fluid for CNS diseases treatment. The current pipeline consists of 18 gene therapies with candidates for GM2 gangliosidosis andCLN1 in preclinical development stages. Its lead candidate TSHA-001 would be the first bicistronic vector to enter human clinical studies. The company is also investing in its own production facilities in Durham, North Carolina, and would profit from housing manufacturing, development, and quality control in one location. Their new production lines are expected to be fully operational by 2023.

The company raised a total of $125 million in two rounds with Fidelity Management, Research Company, Nolan Capital, and PBM Capital Group as lead investors. The company went public in Sep 2020, raising $157 million.

Tessera

Despite numerous breakthroughs in the areas of gene editing, there are still limitations of existing CRISPR-Cas technology which is mainly targeting single point-mutations and failing for longer sequences. Tessera’s innovative approach to gene-editing relies on using DNA transposases that would enable cutting and pasting the entire genes. Transposases along with other nucleases are used to shuffle big chunks of DNA. This could be compared to directly copying a whole sentence instead of changing it letter by letter. The new technology would potentially enable the treatment of genetic diseases that are incurable with other approaches.

Founded in 2018, Tessera raised two rounds, including the latest Series B in January 2021, totaling $230 million. The round was led by Alaska Permanent Fund and SoftBank Vision Fund.

Ensoma

This Boston-based genomic medicine company's key innovation is their Engenious™ vector engineered specifically to deliver genetic material directly to hematopoietic stem-cells or other cells arising from them. This would erase the need to collect stem cells from the patient or use chemotherapy for myeloablative conditioning and potentially yield the single injection therapy. Ensoma's technology would dramatically simplify the storage, logistics and increase the availability of this therapy worldwide.

Founded in 2019, Ensoma recently raised a $70 million Series A round led by 5AM Ventures.

Avrobio

Avrobio, founded in 2015 in Cambridge, MA, is developing notable single-dose gene therapy for rare diseases caused by deficiency or absence of vital enzymes. Such diseases are currently treated with enzyme-replacement therapy (ERT) on a lifetime bi-weekly basis. The gene-therapy approach suggests "cross-correction" when desired protein is produced by the gene-modified cells and transferred to neighboring target cells with the potential of single-dose treatment lasting for 3.5 years. Avrobio developed its own proprietary Plato® platform consisting of viral vectors carrying genetic material and special tags that increase the resulting enzyme activity in the targeted cells. For the moment their lead therapy AVR-RD-01 against Fabry's disease entered Phase I/II clinical trials in 2019.

Avrobio raised $85 million in total funds, including their latest series B of $60M invested by Citadel and Cormorant Asset Management in February 2018. The company went on IPO in June the same year having raised $99.7 million at that time.

AavantiBio

AavantiBio is a biotech startup out of Florida, founded in 2019 and headquartered in Cambridge, MA, which is primarily focused on Friedreich's Ataxia (FA), a rare genetic disease affecting 1 in 40000 people in the US -- a condition caused by single-gene mutations with no treatment available today. The company's approach is based on the pioneering gene therapy research conducted by the co-founders

Barry Byrne, M.D., Ph.D., and Manuela Corti, P.T., Ph.D. at the University of Florida, where the newly formed company also has a partnership with Powell Gene Therapy Center. Currently, their lead therapy against FA is in Phase I clinical trials.

AavantiBio already managed to raise a lofty $107 million series A from some notable healthcare investors, including RA Capital Management, Perceptive Advisors, Bain Capital Life Sciences, and Sarepta Therapeutics. Former Sarepta Therapeutics Chief Commercial Officer and Executive Vice President Alexander Bo Cumbo joined the startup as CEO and President in Oct 2020.

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- Ensoma
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