Children's Mercy Kansas City Announces Breakthrough in Personalized Therapy for Rare Genetic Diseases

KANSAS CITY, MO, UNITED STATES, January 22, 2025 /EINPresswire.com/ -- Children's Mercy Kansas City announces a significant advancement toward the treatment of rare genetic diseases through the use of personalized antisense oligonucleotides (ASOs). This innovative approach has shown promising results in preclinical evaluations, which offers new hope for patients with previously untreatable conditions and validates personalized therapies for patients in only eight weeks, significantly faster and more cost-effective than the industry average.

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> *Scott Younger, PhD, Genomic Medicine Center, Children's Mercy Kansas City*

The groundbreaking study, titled "Rapid and scalable personalized ASO screening in patient-derived organoids," was published in the journal Nature. This marks the first time in five years that research led by a Kansas City institution has appeared in the prestigious publication.

Many labs already generate patient-derived induced pluripotent stem cells (iPSCs), but the process currently takes up to a year and costs between $5,000 and $10,000 per patient. The paper describes a new method that requires only a small number of patient blood cells, can generate iPSCs in just two to three weeks and costs less than $500 per patient. The research team used these patient-derived iPSCs to grow patient-specific organoids, 3-dimensional cell models that recapitulate organ development and function. These organoids are powerful tools for understanding disease biology as well as the development of patient-specific therapeutics.

"The team can generate iPSCs and organoid models for many patients in parallel, leading to an accelerated evaluation of therapeutic interventions," said Scott Younger, PhD, Director, Disease Gene Engineering, Genomic Medicine Center, and leader of The Younger Laboratory, Children's Mercy. "Instead of waiting more than a year for cell models to be generated before experiments could even begin, a family could go from blood draw to diagnosis and/or treatment recommendation in a month or two."

The Children's Mercy Genomic Medicine Center validated the process using samples from three patients enrolled in its Genetic Answers for Kids (GA4K) program with Duchenne muscular dystrophy whose genetic variants were good candidates for treatment with ASOs. They were able to restore dystrophin protein expression and function in patient-derived organoids using an FDA-approved ASO for one patient and customized patient-specific ASOs for the other two patients.

"Patient-derived organoid models have the potential to be widely used in creating cellular systems for investigating disorders involving the heart, kidney, liver and other tissues, in addition to identifying which medications are likely to be effective for a specific patient and which ones may not," said Steve Leeder, PharmD, PhD, Interim Executive Director, Children's Mercy Research Institute. "Having the ability to scale the use of a patient-derived organoid platform uniquely positions us to achieve a 'bedside-to-bench-to bedside-and beyond' approach and helps us prioritize the integration of research with clinical care at Children's Mercy."

The research team hopes this method will be adopted by other institutions to provide faster, better care for rare disease patients worldwide.

"The methods and protocols generated in this study are accessible and can be implemented in any standard research laboratory without the need for specialized equipment or high-cost reagents," said Dr. Younger. "The widespread ability to generate patient-derived cellular systems will have a substantial effect on the understanding of disease mechanisms as well as potential therapeutic avenues for the treatment of many rare disease."

The study's co-authors are John C. Means, PhD, research scientist, Genomic Medicine Center; Anabel L. Martinez Bengochea, PhD, research scientist, Clinical Pharmacology and Toxicology; Daniel A. Louiselle, MS, research assistant, Genomic Medicine Center; Jacqelyn M. Nemechek, PhD, research scientist, Hematology/Oncology/BMT; John M. Perry, PhD, doctoral research faculty, Hematology/Oncology/BMT; Emily G. Farrow, PhD, CGC, Assistant Clinical Director, Clinical Genetics; Tomi Pastinen, MD, PhD, Division Director, Genomic Medicine Center; and Dr. Younger.

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