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SYSTEM FOR SONOGENETIC CONTROL OF ISLET ORGANOIDS FUNCTION FOR TYPE 1 DIABETES TREATMENT

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T-021674

Published date: 5/13/2026

Value Proposition: Non-invasive stimulation strategy that can deliver dynamic glycemic control to treat Type 1 diabetes.

Technology Description

Researchers at Washington University in St. Louis have developed Acoustic-Controlled Insulin Secretion (ACIS), a novel sonogenetic strategy that uses focused, noninvasive ultrasound (US) to command insulin release from transplanted engineered human induced pluripotent stem cell (hiPSC)-derived islet organoids. Compared to other similar physical therapeutic techniques, ultrasound-mediated disease treatment is uniquely non-invasive, uses nonionizing radiation, provides deep penetration and spatial-temporal precision, and can be made cell-type specific, giving it strong potential for translation to large animals and humans. Current treatments for Type 1 diabetes, including multiple daily insulin injections or continuous infusion, are not curative and cannot fully reproduce the timing and magnitude of a normal body's native insulin secretion, resulting in poor glycemic control and leaving patients vulnerable to both high and low blood glucose. While donor islet transplantation can restore endogenous insulin production in selected cases, it is not scalable due to donor scarcity, the need for lifelong immunosuppression, and eventual graft failure. Stem cell-derived islet organoids are a promising cell source, but limited functional maturity remains a major bottleneck for clinical translation.

Sonogenetics offers several unique advantages, such as non-incision, non-ionizing radiation, deep penetration, spatial temporal precision, and cell-type specificity. This technology maximizes targeted efficacy while minimizing risk of toxicity, immunogenicity, and off-target activation. Designed to close the glucose responsiveness gap that has limited the clinical performance of hiPSC-derived islets, ACIS offers a mechanistically grounded, testable pathway toward transformative β-cell replacement therapy capable of restoring dynamic, physiologic glycemic regulation for T1D.

Stage of Research

- POC in vivo studies

Applications

- Type 1 diabetes treatment

Key Advantages

- Capable of restoring dynamic, physiologic glycemic regulation for T1D
- Maximizes targeted efficacy while minimizing risk of toxicity
- Can regulate hormone secretion from other endocrine cell types in a range of endocrine deficiencies and metabolic disorders

Patents
Patent pending

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