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Synthetic microRNAs for cellular engineering

Stanford researchers have developed a high-throughput platform that designs, delivers, and screens synthetic microRNAs to precisely reprogram human T cells and improve the efficacy of CAR T cell therapies.

Chimeric Antigen Receptor (CAR) T cell therapies have shown promise in treating blood cancers but remain largely ineffective against solid tumors. Traditional approaches to enhancing T cell function, such as gene knockouts or overexpression of proteins, have limited precision and scope. While some natural microRNAs (miRNAs) have demonstrated the ability to improve T cell performance, the ability to design and harness synthetic miRNAs for precise cellular reprogramming remains underexplored.

To address this challenge, Stanford researchers have developed a high-throughput platform that uses a library of over 24,000 barcoded synthetic miRNAs to reprogram human T cells. These miRNAs are delivered via homology-directed repair templates and tested using pooled functional screening. This approach rapidly identifies synthetic miRNAs that improve CAR T cell survival, proliferation, and anti-tumor activity, offering a more precise and scalable way to enhance CAR T cell therapies, especially against solid tumors where traditional protein-based strategies have been less effective.

Stage of development
Research: in vitro.

Applications

- Cell therapy
- Regenerative medicine
- Drug discovery

- Synthetic biology tools

Advantages

- Expanded functional capabilities
- Scalable and high-throughput platform
- Versatile across cell types
- Complementary to existing tools

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