# Functionalized Nanowires for miRNA-mediated Programming of Naive T Cells

**Naive state of T cells can be unstable and limited in efficacy**

From cancer to infectious diseases, engineered immune cells have the potential to treat a wide range of maladies. T cells are a fundamental part of cellular immunology, but the technology currently available makes it difficult to maintain the naive state of T cells while still being able to enhance their efficacy. Current ex vivo engineering methods necessitate pre-activating T cells, leading to the loss of their naïve characteristics. T cells that have been activated have a limited ability to adapt to new challenges, are likely to become short-lived effector T cells instead of canonical memory T cells, and are prone to exhaustion.

**Innovation allows for methods without the activation of T-cells and preserves cell viability**

Researchers at the Georgia Institute of Technology are developing a specialized nanowire to deliver genetic material to primary naive T cells without having to pre-activate them. This technology allows for the delivery of large, whole lentiviral particles with potential for long-term integration. Additionally, this method preserves the cells' viability and increases the potential to respond effectively to a wide range of new infections or threats.

This invention involves the use of needle-like nanostructures, or nanowires, that are functionalized to deliver crucial genetic materials, such as microRNAs (miRNAs) and CRISPR, directly to primary, naive T cells. Unlike existing methods which require pre-activation of T cells, compromising their effectiveness in adoptive cell therapy, this approach maintains the cells' naive state, enhancing their therapeutic potential. The nanowires permit the dual delivery of miRNAs, enabling precise control over T cell differentiation and function, and opening new avenues for treating a wide range of diseases including infections and cancer.

**Summary Bullets**

- **Technology Overview:** Georgia Tech's functionalized nanowires deliver genetic materials like miRNAs and CRISPR directly to naive T cells, enhancing their therapeutic potential without pre-activation.
- **Advantages:** This method preserves the naive state of T cells, allowing for better viability and functionality, reduced exhaustion, and delivery of both small and large biomolecules, including lentiviral particles.

- **Commercial Applications:** The technology can be used in adoptive T cell therapy for cancer and infectious diseases, therapeutic delivery of biomolecules, and as a research tool for immune cell manipulation.

Solution Advantages

- Direct delivery of genetic material to naive T cells without the need for pre-activation.
- Enhanced viability and functionality of programmed T cells.
- Ability to deliver both small and large biomolecules, including miRNAs and lentiviral particles.
- Significant reduction in T cell exhaustion compared to traditional methods.
- Potential for broad application across different species, ages, and T cell subtypes.

Potential Commercial Applications

- Adoptive T cell therapy for infectious diseases, cancer, and other maladies.
- Delivery of small and large biomolecules to primary immune cells for therapeutic purposes.
- Research tool for manipulating immune cell fate for scientific studies.

**Inventors**


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**IP Status**

Patent application has been filed. :

**Publications**


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**Images**

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