Invariant Natural Killer T Cell Receptor (iNKT TCR) Gene-Based Immunotherapy

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Hematopoietic Stem Cells (HSCs), Invariant Natural Killer T-Cells (iNKT cells), Cancer Immunotherapy, Stem Cells, Genetic Engineering

CATEGORIZED AS

- **Medical**
  - Disease: Autoimmune and Inflammation
  - Disease: Cancer
  - Stem Cell
  - Therapeutics

RELATED CASES

2015-019-0

SUMMARY

UCLA researchers have developed a novel invariant natural killer T cell (iNKT)-based immunotherapy for targeting cancer, infections, allergies and autoimmune disorders.

BACKGROUND

Invariant natural killer T (iNKT) cells are a subset of T lymphocytes that display natural killer (NK) cell features and express semi-invariant T cell receptors (TCRs). iNKT cells bridge the innate and adaptive immunity and have been shown to play crucial roles in immune response and tumor surveillance. Because of their importance and unique property to function without MHC restriction, these cells can function as “universal” cellular reagents for treating multiple diseases, thus are highly attractive candidate for cell-based immunotherapy. However, one limitation that prevents their use is the small number of iNKT cells in vivo (~0.01 to 1% in human blood). Current methods to expand these cells from patients’ peripheral blood have been proven costly, time-consuming and highly variable between patients. Novel approaches that can generate a large supply of iNKT cells will greatly aid in the use of these cells for therapy.

INNOVATION

Using a novel iNKT TCR gene engineering approach, Dr. Lili Yang and colleagues at UCLA are able to engineer blood stem cells to generate large numbers of iNKT cells. Furthermore, using clinically approved immunization methods, these engineered iNKT cells can be activated and expanded further in vivo when desired. In a proof-of-concept study using an established mouse model of melanoma lung metastasis, the researchers demonstrated this new approach to be highly effective in protecting the animals from tumor metastasis.

APPLICATIONS

- Broad therapeutic potential in oncology: solid tumors, leukemia and lymphomas
- A cell therapy treatment candidate for aggressive autoimmune diseases and allergies
- Research tool/method to generate iNKT cell to study its function and properties

ADVANTAGES

- Proposed method is more cost-efficient than previously described methods (i.e. generation of
- iNKT cells from iPS cells or donor patient cell enrichment)
- Cells are obtained autologously, bypassing concerns of tissue rejection
- iNKT cell activation of tumor-targeting NK cells and conventional T-cells limits risk of off-target effects
- The iNKT stimulatory agent, α-GalCer, provides a clinical tool for augmenting therapy without necessitating cell transfer
- Transplantation of the iNKT TCR-engineered blood stem cells offer a potent, life-long treatment option

STATE OF DEVELOPMENT

The engineered cells were successfully generated and transplanted into recipient mice. Characterizations on these cells have been completed and were demonstrated to have long-term survival, to be functional in eliciting an immune response, and possess antitumor activity.

RELATED MATERIALS

- Genetic engineering of hematopoietic stem cells to generate invariant natural killer T cells. PNAS (2015)

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,187,777	01/07/2025	2015-019
United States Of America	Issued Patent	10,927,160	02/23/2021	2015-019
United States Of America	Published Application	20250223333	07/10/2025	2015-019

Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- HSC-Engineered Off-The-Shelf iNKT Cell Therapy For Cancer

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