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Generation of NK and Innate Lymphoid Cells from human stem cells (20110085, Dr. Michael Verneris)

Drs. Verneris, Miller and Blazar developed a method to create large numbers of Natural Killer cells and Innate Lymphoid Cells from hematopoietic stem cells.

Limited access to promising cells for therapeutics

The use of human cells as therapeutics is an area of rapid expansion and has made it possible to treat diseases that have no other options available. Development of cellular therapeutics is drastically hindered by labor intensive processes required to obtain even small amounts of pure cell populations. Natural Killer (NK) cells have been widely identified as a promising therapeutic for a variety of cancers and viral infections (including HIV), but are resistant to gene manipulation and can only be obtained from a blood draw. A related cell population, group 3 innate lymphoid cells (ILC3s) have been shown to be important for the integrity of mucosal tissues, such as the gastrointestinal tract and are thought to be important in the formation and homeostasis of secondary lymphoid tissue and could facilitate immune recovery after chemotherapy or bone-marrow transplants. Unfortunately, the only method currently available to obtain these cells is to harvest them from surgically removed lymph nodes, tonsils or from aborted fetal tissue. Despite the potential clinical application, this serious limitation has effectively barred any genuine progress in fully understanding these cells and/or developing them as a therapeutic.

A new method of cell production

To bypass these limitations, Drs. Michael Verneris, Jeffrey Miller and Bruce Blazar at the University of Minnesota developed methods to create large quantities of NK cells or ILC3 cells from hematopoietic stem cells (HSCs). In the case of NK cells, this technology could facilitate genetic manipulation of NK cells (which are inherently resistant to gene editing) by introducing alterations to HSCs prior to differentiation. This includes the addition of a chimeric antigen receptor (CAR) that would allow re-directing NK cells to tumor antigens. This technology also represents the first method to produce ILC3 cells in high numbers. This approach would not use lymph node biopsies, tonsillectomies or human fetal tissue. This work will facilitate foundational clinical trials of ILC3 adoptive transfer which could serve as novel studies in areas of chemotherapy induced mucosal injury .

Phase of Development

Proof of concept: demonstrated reproducible ability to generate NK and ILC3 cells from HSCs (obtained from umbilical cord blood) with the expected phenotypic markers and functional characteristics.

Features & Benefits

Technology ID

20110085

Category

Life Sciences/Human Health
Life Sciences/Pharmaceuticals
Life Sciences/Therapeutics
Agriculture & Veterinary/Veterinary Medicine

Learn more

- **Utilizes a more readily available cell source:** Allows the production of NK and ILC3 cells from HSC, bypassing the need to harvest cells from limited and controversial sources including lymph nodes and aborted fetal tissues.
- **Produces large quantities of cells:**Differentiation and growth of HSCs to NK cell types increases the number of cells 1000 fold
- **Facilitates gene editing of NK cells:**While NK cells are inherently difficult to genetically alter, HSCs can be edited prior to differentiation.

Applications

- Production of NK and ILC3 cells for basic research
- Cellular therapeutic development
- Generation of 3D secondary lymphoid tissues ex-vivo

Researchers

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Publications

Coordinated acquisition of inhibitory and activating receptors and functional properties by developing human natural killer cells
Blood, 2006 Dec 1;108(12):3824-33
In vitro development of human Killer-Immunoglobulin Receptor-positive NK cells
Methods Mol Biol, 2010;612:15-26.
Development of IL-22-producing NK lineage cells from umbilical cord blood hematopoietic stem cells in the absence of secondary lymphoid tissue.
Blood, 2011 Apr 14;117(15):4052-5.

Ready for Licensing

This technology is now available for license! The University is excited to partner with industry to see this innovation reach its potential. Please contact us to share your business' needs and your licensing interests in this technology. The license is for the sale, manufacture or use of products claimed by the patents.