

## Using Stem Cells to “Cure” Baldness

Published: Jun 28, 2019 | By Mark Terry

Using human induced pluripotent stem cells (iPSCs), researchers with Sanford Burnham Prebys Medical Discovery Institute in La Jolla, California, were able to grow natural-looking hair that grows through the skin.

The research group, led by Alexey Terskikh, associate professor in Sanford Burnham Prebys’ Development, Aging and Regeneration Program and co-founder and chief scientific officer of Stemson Therapeutics, evaluated dermal papilla, a type of cell. These cells are found inside the hair follicle and control hair growth, including thickness, length and growth cycle. Four years ago, in 2015, Terskikh grew hair underneath mouse skin by using human PSCs to create dermal papilla. Since then, the group has refined the process and applied more control.



“Our new protocol described today overcomes key technological challenges that kept our discovery from real-world use,” Terskikh stated. “Now we have a robust, highly controlled method for generating natural-looking hair that grows through the skin using an unlimited source of human iPSC-derived dermal papilla cells. This is a critical breakthrough in the development of cell-based hair-loss therapies and the regenerative medicine field.”

The researchers used a 3D biodegradable scaffold built out of the same material used in dissolvable stitches. This structure controls the direction of hair growth and assists the stem cells in integrating into the skin. The present protocol depends on mouse epithelial cells combined with human dermal papilla cells.

The experiments were performed in immunodeficient nude mice, who have no body hair.

The Terskikh lab is working on deriving the epithelial part of a hair follicle from human iPSCs. This combination of human iPSC-derived epithelial and dermal papilla cells would allow for the growth of completely human hair follicles, ready for transplant. Terskikh indicates that the advantage to this approach is there is an unlimited supply of cells that can be derived from a straightforward blood draw.

“Hair loss profoundly affects many people’s lives,” stated Richard Chaffoo, a triple board-certified plastic surgeon who founded La Jolla Hair MD and is a medical adviser to Stemson Therapeutics. “I am eager to advance this groundbreaking technology, which could improve the lives of millions of people who struggle with hair loss.”

The research was presented by lead researcher Antonella Pinto, a postdoctoral researcher in the Terskikh lab at the annual meeting of the International Society for Stem Cell Research (ISSCR). The presentation received a Merit Award. Stemson Therapeutics has licensed the technology.

Current hair loss drugs include minoxidil (Rogaine) or finasteride (Propecia, Proscar). There are also hair transplants, which have been performed in the U.S. since the 1950s, although the techniques have changed significantly since their introduction. In the U.S., the costs of hair transplants run from about \$4000 to \$15,000 and are usually not covered by insurance.

There have also been other breakthroughs in treating baldness. In 2017, South Korean researchers developed a biochemical that encouraged new hair follicle growth. They discovered a protein called CXXC-type zinc finger protein 5, which binds to the Dishevelled protein. This binding interrupts the development and regeneration of hair follicles. Their product, PTD-DBM, prevents that binding process.

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