Functional hair follicles grown from stem cells

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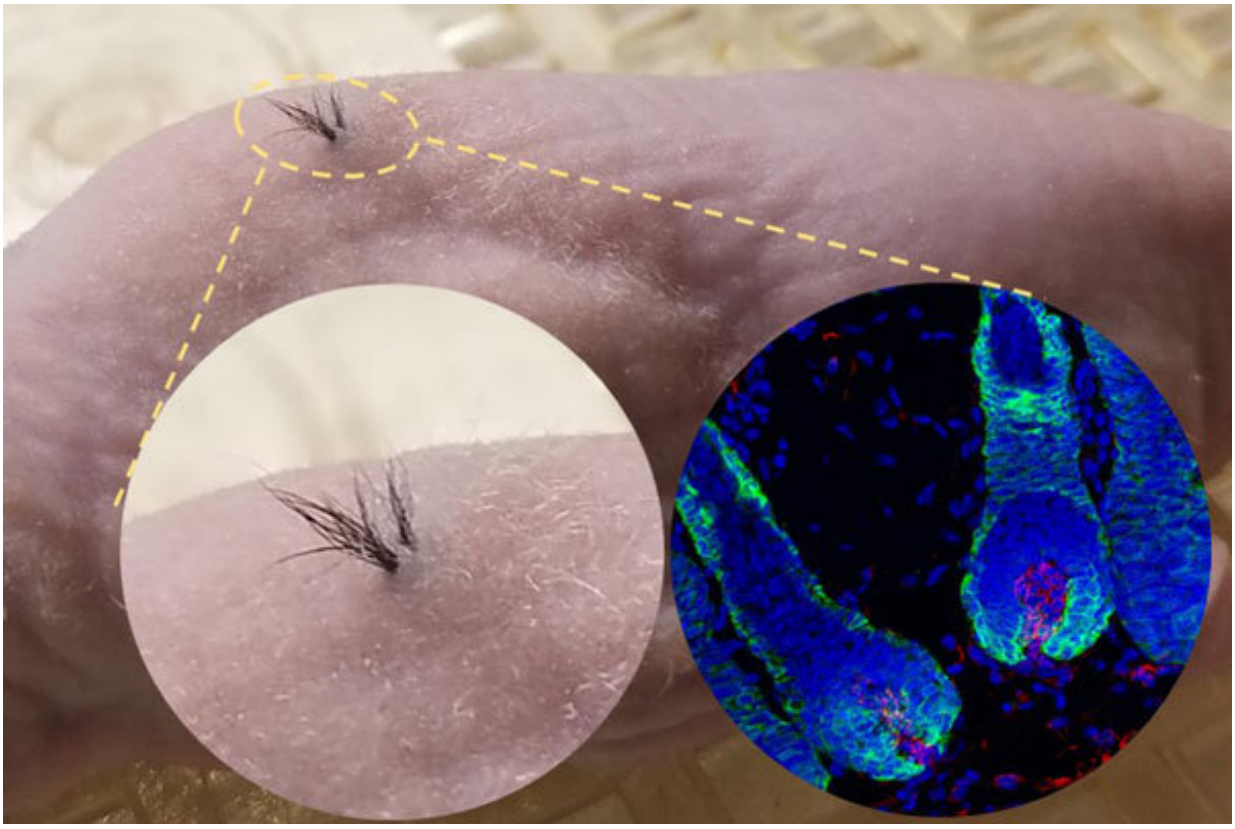


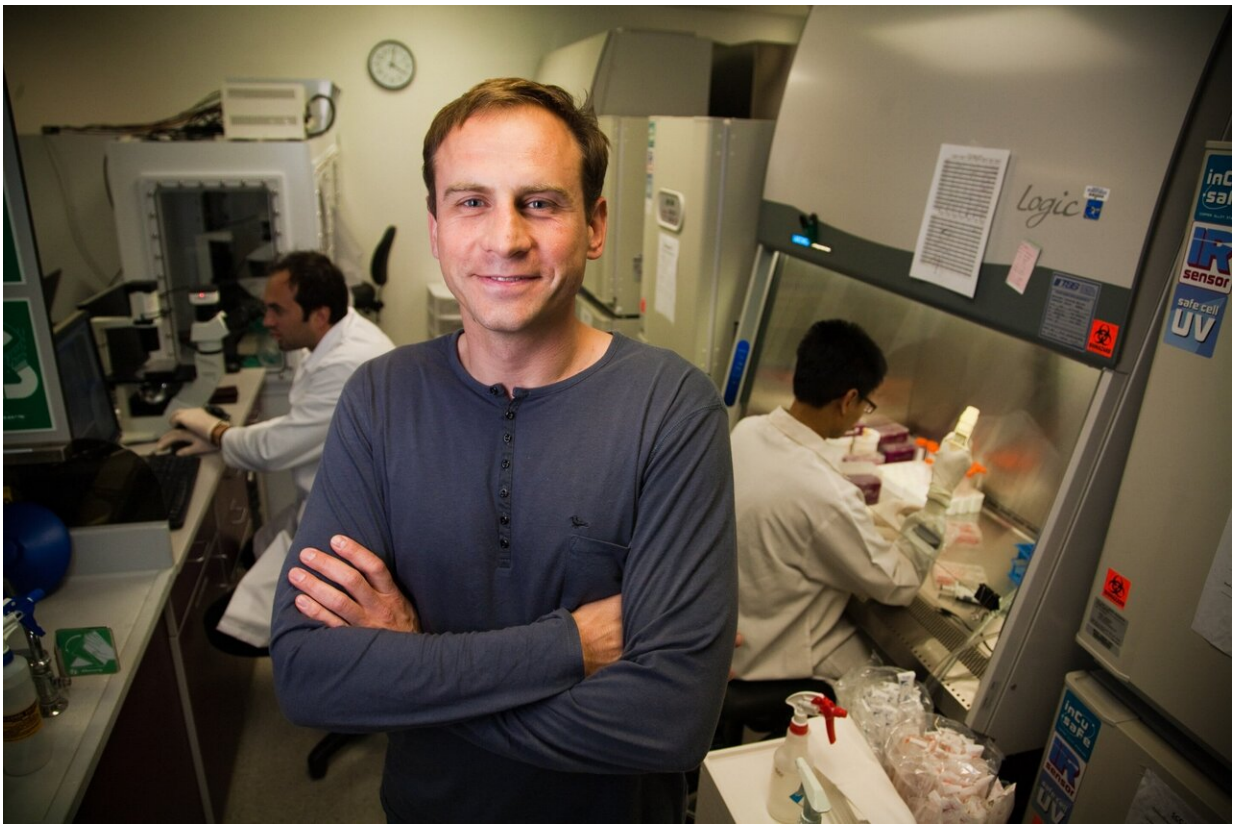
Hair growth in nude mice transplanted with human iPSC-derived dermal papilla cells that were combined with mouse epithelial cells inside a biodegradable scaffold. Left insert: enlarged outside view. Right insert: fluorescent microscopy image of hair follicles under the skin; cell nuclei (blue), epithelial cells (green), human dermal papilla cells (red). Credit: Sanford Burnham Preybs

Scientists from Sanford Burnham Prebys have created natural-looking hair that grows through the skin using human induced pluripotent stem cells (iPSCs), a major scientific achievement that could revolutionize the hair growth industry. The findings were presented today at the annual meeting of the International Society for Stem Cell Research (ISSCR) and received a Merit Award. A newly formed company, Stemson Therapeutics, has licensed the technology.

More than 80 million men, women and children in the United States experience hair loss. Genetics, aging, childbirth, cancer treatment, burn injuries and medical disorders such as alopecia can cause the condition. Hair loss is often associated with emotional distress that can reduce quality of life and lead to anxiety and depression.

"Our new protocol described today overcomes key technological challenges that kept our discovery from real-world use," says Alexey Terskikh, Ph.D., an associate professor in Sanford Burnham Prebys' Development, Aging and Regeneration Program and the co-founder and chief scientific officer of Stemson Therapeutics. "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."

Terskikh studies a type of cell called dermal papilla. Residing inside the hair follicle, these cells control hair growth, including hair thickness, length and growth cycle. In 2015, Terskikh successfully grew hair underneath mouse skin (subcutaneous) by creating dermal papilla derived from human pluripotent stem cells—a tantalizing but uncontrolled process that required further refinement.



Alexey Terskikh, Ph.D., an associate professor in Sanford Burnham Prebys' Development, Aging and Regeneration Program and the co-founder and chief scientific officer of Stemson Therapeutics. Credit: Sanford Burnham Prebys

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The approach detailed in the ISSCR presentation, which was delivered by lead researcher Antonella Pinto, Ph.D., a postdoctoral researcher in

the Terskikh lab, features a 3-D biodegradable scaffold made from the same material as dissolvable stitches. The scaffold controls the direction of hair growth and helps the stem cells integrate into the skin, a naturally tough barrier. The current protocol relies on mouse epithelial cells combined with human dermal papilla cells. The experiments were conducted in immunodeficient nude mice, which lack body hair.

The derivation of the epithelial part of a hair follicle from human iPSCs is currently underway in the Terskikh lab. Combined human iPSC-derived epithelial and dermal papilla cells will enable the generation of entirely human hair follicles, ready for allogenic transplantation in humans. Distinct from any other approaches to hair follicle regeneration, human iPSCs provide an unlimited supply of cells and can be derived from a simple blood draw.

"Hair loss profoundly affects many people's lives. A significant part of my practice involves both men and women who are seeking solutions to their hair loss," says Richard Chaffoo, M.D., F.A.C.S., 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."

Provided by Sanford Burnham Prebys Medical Discovery Institute