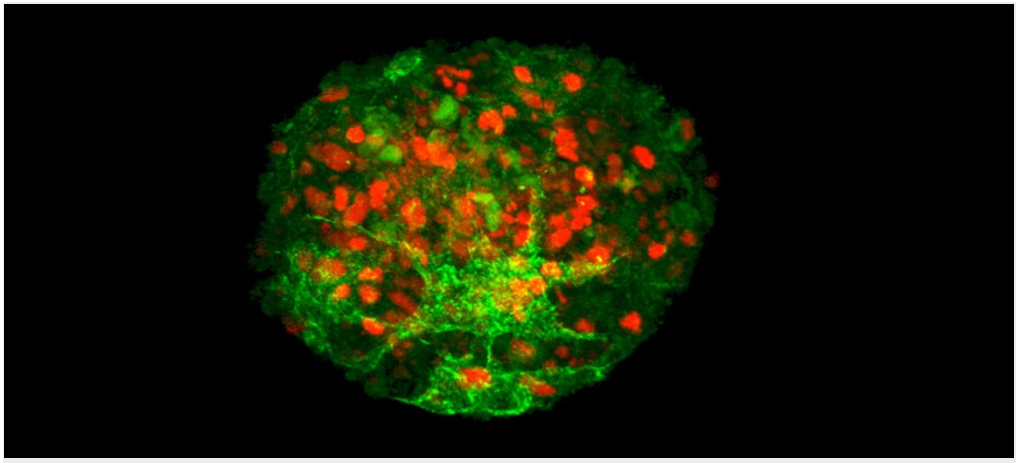
NATURE | NEWS

Cultured follicles offer hope for beating baldness

Old cell-growth method moves hair restoration technique from mice to humans.

Brian Owens

21 October 2013



Claire Higgins/Christiano Lab at Columbia University Medical Center

Clusters of cultured cells from human hair follicles successfully produced new human hair when transplanted back into human skin.

Life seemed to be unfair to balding people. More than four decades ago, scientists found a way to grow hair follicles in hairless rodents by cultivating skin cells in a dish and implanting them under the skin. But when they tried the same thing in humans, it never worked. Now, a simple tweak to the culturing technique shows that there might be hope for countering baldness.

Follicles develop from dermal papilla cells in the skin. When scientists harvest such cells from mice and culture them in a Petri dish, the cells multiply and form a clump. But the same does not happen for human cells. Geneticist Angela Christiano at Columbia University in New York and her colleague Colin Jahoda, a cell biologist at Durham University, UK, wondered whether the rodent cells' ability to group together was what allowed them to induce follicles successfully.

So the team tried placing the human papilla cells in a hanging-drop culture — a 100-year-old technique in which the cells hang in droplets of a carrier medium underneath the lid of a Petri dish. Gravity causes the cells to cluster together at the bottom of the drop in a more natural, three-dimensional (3D) configuration, rather than spreading out on a flat plane.

“The drop culture allows them to maintain their spatial context and develop an extracellular matrix,” says Christiano. “That seems to allow the cells to recognize that they can induce follicles.”

Good hair day

When the drop-culture cells were implanted under hairless human skin that was grafted onto the back of a rat, they induced the development of follicles. The work is published in this week's issue of *Proceedings of the National Academy of Sciences*[1].

Christiano found that growing cells on a flat surface disrupted the expression of nearly 4,000 genes, whereas the hanging-drop method restored normal function to about 22% of those — enough, it seems, to allow them to induce follicles. Several of the genes restored had been previously associated with hair growth, including an important signalling pathway known as Wnt, which transmits signals from outside the cell to inside. Still, says Christiano, “we were surprised at how few were enough to start induction”.

Anthony Oro, an epithelial biologist at Stanford University in California, says that it is perhaps not surprising that the structure of the cellular clumps is so crucial. “Why would we think that if we take a beautiful 3D structure and make it flat, that the cells would have any chance to retain their properties? It’s a big thing to ask a cell.”

He adds that the latest work is exciting, even though the hair produced is “not yet ready for prime time”. The new follicles did not

always produce a hair through the skin, and they lacked pigment and sebaceous oil glands. Christiano says that it will be some time before those kinks are ironed out and the method is ready for the clinic. The method could also be developed into an *in vitro* tissue-screening model to test hair loss and hair-restoration drugs, he says.

Nature | doi:10.1038/nature.2013.13983

References

1. Higgins, C. *et al. Proc. Natl. Acad. Sci. USA* http://dx.doi.org/10.1073/pnas.1309970110 (2013).