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Skin stem cells

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Using stem cells obtained from skin is the therapeutic holy grail being sought for treatment of baldness and numerous skin diseases. Elaine Fuchs and colleagues at the Rockefeller University in New York, USA (http://www.rockefeller.edu), now show that stem cells grown in the laboratory from a single cell can be grafted to the back of a hairless mouse, producing a little tuft of fur, as well as new skin and functioning sebaceous glands [1].

What constitutes 'stemness'?

The novelty of their findings involved taking adult keratinocytes and confirming their 'stemness' (the ability to propagate and differentiate) using the grafting technique, effectively demonstrating that the cells from this stem cell niche were multipotent, explains William Lowry, a postdoctoral fellow and joint first author of the paper with colleague Cedric Blanpain.,' says Lowry. 'It was always somewhat assumed but was based on conjecture. The unique thing was that we were able to show it at the clonal level.'

Using microarray gene expression, they also showed that these stem cells expressed more than 50 genes known to be expressed by other types of stem cells, including blood, embryonic and neural stem cells, suggesting that the expressed genes are responsible for their 'stemness'.

Lineage mapping cell fates

Furthermore, the group's findings are the first to follow the fate of these cells *in vivo*. 'Up to now, there has been no way to lineage map the fate of a stem cell in the body,' says Angela Christiano, a researcher at Columbia University (New York, USA; http://www.columbia.edu), who wrote the accompanying

commentary in the same issue of *Cell* [2]. 'This method provides *in vivo* lineage tracing in the hair follicle – a hugely valuable technical advance.'

Using stem cells as well as cells that had already begun to differentiate into the hair follicle/shaft, Fuch's group showed that both sets of cells could give rise to new skin and hair follicles, explains Christiano. 'The cells had the potential to change their mind and revert to being more stem-like, thereby giving rise to the epidermis, hair follicle and sebaceous gland,' she says. 'The surprise was that, when grafted back on nude mice, both populations gave rise to new skin and hair follicles. They also showed that a single stem cell can give rise to everything – this is important.'

A potential treatment for hair loss

George Cotsarelis, a dermatologist and scientist at the University of Pennsylvania (Philadelphia, USA; http://www.upenn.edu), says that this could one day lead to a treatment for hair loss. 'You could generate more hair follicles than you started with, so that's really the implication here,' he says. Cotsarelis and colleagues were the first to publish the antibody technique used to isolate the stem cells [3].

In the meantime, Lowry says that they are currently studying the signalling mechanisms with that stem cell niche responsible for regulating the hair cycle. 'Understanding the signalling mechanism behind that will make it easier to understand what happening to the follicle when that's going wrong,' he says.

As for potential therapies, Christiano says that these findings provide the foundation for eventually being able to purify cells from human skin for use in gene therapy. Although it isn't known if these cells can be differentiated into other cell types, she says that both the skin and hair follicle are an accessible source of adult stem cells and is the obvious choice to pursue these possibilities.

References

1 Blanpain C. *et al.* (2004). Self-renewal, multipotency, and the existence of two cell populations within an epithelial stem cell niche. *Cell* 118, 635–648

2 Christiano, A.M. (2004). Epithelial stem cells: stepping out of their niche. *Cell* 118, 530–532

3 Trempus, C.S. *et al.* (2003) Enrichment for living murine keratinocytes from the hair follicle bulge with the cell surface marker CD34. *J. Invest. Dermatol.* 120, 501–511

Hitting the target in medulloblastoma therapy

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Researchers report that a small-molecule inhibitor of the Sonic Hedgehog (Shh) pathway can eradicate medulloblastomas in a mouse model of this brain malignancy [1]. HhAntag691, a benzimidazole derivative that blocks

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