A simplified procedure to reconstitute hair producing skin

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Tissue Engineering, in press.

I. ABSTRACT

One of the major objectives of tissue engineering is to reconstitute skin from stem cells. This requires multi-potent skin stem cells and the ability to guide these cells to form a piece of skin with proper architecture and skin appendages. Based on previous progress, we develop a simplified procedure that can be useful for large-scale screening of factors that can modulate the hair formation ability of candidate cells. Newborn mouse cells are used. Dissociated epidermal and dermal cells in high density suspension are allowed to reconstitute in vitro to generate its own matrix, or seeded into a scaffold-like matrix already used clinically. These cells self-organize and form a reconstituted skin with proper proportions and topological organization of different components. Large numbers of hair follicles form. The cellular and molecular events are characterized, showing a distinct but parallel morphogenetic process compared to those occurring in embryonic development. The formed hair follicles can cycle and regenerate and the reconstituted skin can heal after injury. The skins are in good condition one year after transplant. This procedure enables flexible size and shape of the reconstituted skin, so that clinical applications can be envisioned for the future when large numbers of multi-potential skin stem cells become available.
II. A BRIEF NOTE—on the making of this team work  This is a good example of successful collaboration between basic biology and clinical medicine. Dr. Lee is a resident and Dr. Garner is a faculty in plastic surgery of USC. Dr. Lee likes to do research and got a two year NIH grant to do research. She came to me because she wants to do something related to stem cells. Dr. Jiang in my laboratory has reconstituted feather follicles from dissociated cells before. So I put them together to work on reconstituting hairs. The result is this simplified procedure which can be used to screen for molecules that can help make better hairs, and also a procedure with hairs form on a plane (not cyst, like some prior procedure) that are "cosmetically acceptable" (Lee's word). Using this assay, I developed a NIH RO1 grant to further explore skin stem cells. Lily Lee is back to finish her residency now. She also had so much fun in doing science, she told me she wants to apply for physician scientist award from NIH (junior faculty level) once she finishes her residency. It shows how we develop a new project as a team, and also how NIH foster future physician scientists.

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