

Growing skin in the lab

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Using reprogrammed iPS cells, scientists from the RIKEN Center for Developmental Biology (CDB) in Japan have, along with collaborators from Tokyo University of Science and other Japanese institutions, successfully grown complex skin tissue—complete with hair follicles and sebaceous glands—in the laboratory. They were then able to implant these three-dimensional tissues into living mice, and the tissues formed proper connections with other organ systems such as nerves and muscle fibers. This work opens a path to creating functional skin transplants for burn and other patients who require new skin.

Research into bioengineered tissues has led to important achievements in recent years—with a number of different [tissue](#) types being created—but there are still obstacles to be overcome. In the area of [skin](#) tissue, epithelial cells have been successfully grown into implantable sheets, but they did not have the proper appendages—the oil-secreting and sweat glands—that would allow them to function as normal tissue.

To perform the work, published in *Science Advances*, the researchers took cells from mouse gums and used chemicals to transform them into stem cell-like iPS cells. In culture, the cells properly developed into what is called an embryoid body (EB)—a three-dimensional clump of cells that partially resembles the developing embryo in an actual body. The researchers created EBs from iPS cells using Wnt10b signaling and then implanted multiple EBs into immune-deficient mice, where they gradually changed into differentiated tissue, following the pattern of an actual embryo. Once the tissue had differentiated, the scientists transplanted them out of those mice and into the skin tissue of other mice, where the tissues developed normally as integumentary tissue—the tissue between the outer and inner skin that is responsible for much of the function of the skin in terms of hair shaft eruption and fat excretion. Critically, they also found that the implanted tissues made normal connections with the surrounding nerve and muscle tissues, allowing it

to function normally.

One important key to the development was that treatment with Wnt10b, a signaling molecule, resulted in a larger number of hair follicles, making the bioengineered tissue closer to natural tissue.

According to Takashi Tsuji of the RIKEN Center for Developmental Biology, who led the study, "Up until now, artificial skin development has been hampered by the fact that the skin lacked the important organs, such as hair follicles and exocrine glands, which allow the skin to play its important role in regulation. With this new technique, we have successfully grown skin that replicates the function of normal tissue. We are coming ever closer to the dream of being able to recreate actual organs in the lab for transplantation, and also believe that tissue grown through this method could be used as an alternative to animal testing of chemicals."

More information: *Science Advances* [DOI: 10.1126/sciadv.1500887](https://doi.org/10.1126/sciadv.1500887)

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