

# Development of regenerative skin organ system with skin appendages

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The skin plays essential roles in temperature control, barrier, bacteriostatic action, buffering action, and excretory action. Three-dimensional (3D) human skin equivalents (HSEs) are widely used for researches in the field of cosmetology and skin care biology as alternative model for animal experiments. However, the conventional HSE has quite simple structure consists of epithelium and dermis, and can partially mimics the physiological function of natural skin due to the lack of skin appendages such as hair follicles, sebaceous glands, and sweat glands.

In this study, we aimed to develop a three-dimensional regenerated skin organ system with the same tissue structure and function as the natural skin. To this end, 1) we developed a novel HSE that maintains the normal ECM and cellular alignment observed in the natural skin in accordance with tension by reproducing tensional homeostasis. 2) We established a technology to regenerate mature hair follicles *in vitro* and succeeded in constructing a skin organ system (Bioskin) *in vitro* by incorporating the mature hair follicles into functional three-dimensional human skin. This Bioskin was able to maintain hair shaft growth, demonstrating usefulness of the Bioskin as an *in vitro* evaluation model that have similar function as a natural skin organ system. Our study will provide the basic technology and novel skin model not only for cosmetology but also for clinical field.