In Pursuit of a Next-generation Antiperspirant Mandom Succeeds in Isolation of Sweat Gland Stem Cells Possessing the Ability to Regenerate Sweat Gland-like Structures In Vitro

Mandom Corporation (Headquarters: Osaka; President Executive Officer: Motonobu Nishimura; hereafter, Mandom) has, as part of its Laboratory of Advanced Cosmetic Science (Collaborative Research Laboratory between Osaka University Graduate School of Pharmaceutical Sciences and Mandom), been involved in the development of foundational technologies for the creation of next-generation deodorants for the control of sweating.

At present, in collaboration with Osaka University's Institute for Protein Research, Graduate School of Medicine, and Graduate School of Pharmaceutical Sciences, we investigated the replication of sweating function.

Previous studies have revealed that stem cells are present in epidermis and hair follicles of human; they contribute to the maintenance of the functions of each organ. However, it has remain unknown whether existence of stem cells in human sweat glands, because the procedure for isolation of sweat gland cells have not been established.

Therefore, we first focused on a method for isolating sweat gland cells from the human skin (with the approval of the ethics committee) and identified the markers that accurately discriminate the compartments consisting of human sweat glands. In addition, we identified sweat gland stem cells within sweat gland cells and succeeded in regenerating a sweat gland-like structure in vitro from the sweat gland stem cells. These results led to improved methods for the evaluation of the sweating function of the sweat glands and enabled the direct application of antiperspirants—medicines that, primarily, seal off sweat glands—to sweat glands. This enabled the proposition of a new mechanism of action for antiperspirants—one that "improves the amount and quality of sweating."

We plan to present these findings at the International Federation of Societies of Cosmetic Chemists' Orlando Conference, held in the United States between October 30 and November 2, 2016.

1. Establishment of a Method for Isolating Sweat Glands from the Human Skin Tissue

The mechanism of sweating from sweat glands has not yet been investigated. In recent years, remarkable progress has been made in the application of regenerative medicine technologies to replicate sweat glands as a technique applicable to the treatment of diseases specific to the sweat glands. To resolve unpleasant sudomotor dysfunction such as excessive sweating or smell, we focused on the improvement of sweating function by regenerating sweat glands. To clarify the localization of stem cells in the sweat glands, we first developed a method for the high-purity isolation of four cell populations consisting of human sweat glands.

Human sweat glands divided into the duct that carries sweat to the skin surface and the secretory portion that produces and releases sweat. The duct is composed of luminal cells and basal cells, and the secretory portion is composed of luminal cells and myoepithelial cells (Figure 1). We identified the markers (αSMA, Keratin8, S100P, and S100A2) that exclusively distinguish four populations consisting of sweat gland (Figure 2).

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This enabled the establishment of a method for isolating highly pure luminal cells and myoepithelial cells from the secretory portions of the human sweat glands (Figure 3). This method not only allowed the analysis of sweat gland stem cells, but also can be applied to various kinds of sweat gland studies

2. Discovery of Sweat Gland Stem Cells that Maintain Sweat Gland Function

Using the established sweat gland cell isolation method, we sought to investigate the population that contain sweat gland stem cells. To demonstrate the sweat gland stem cells, we have to substantiate whether the cells possess self-renewal ability (ability to replicate on its own multiple times) and multipotency (ability to change into multiple cell types). We evaluated whether the sweat gland cell compartments isolated from the human skin tissues possess self-renewal ability and multipotency and found that myoepithelial cells possess these abilities. Thus, we clarified that the myoepithelial cells are sweat gland stem cells (Figure 4).

3. Success in the Regeneration of Sweat Gland-like Structures from Sweat Gland Stem Cells

Success in the Regeneration of Sweat Gland-like Structures from Sweat Gland Stem Cells

After using αSMA and Keratin8 to assess the cross-sections of the spheres generated from myoepithelial cells, we found that αSMA, a marker for myoepithelial cells, was detected on the outer layers of the sphere, whereas Keratin8, a marker for luminal cells, was detected in the inner part of the sphere, indicating that the outer and inner parts of the spheres were composed of myoepithelial cells and luminal cells, respectively. These findings revealed that the sphere regenerated from myoepithelial cells is a sweat gland-like structure (Figure 5).

In the future, we intend to investigate the sweating function of sweat glands using the sweat gland-like structure.

Mandom will continue to proactively prioritize the effects and feelings of consumers in the development of highly effective antiperspirants that can satisfy those that use them.

[Reference Material]

Figure 1: The Four Cell Populations that Consist of the Human Sweat Gland

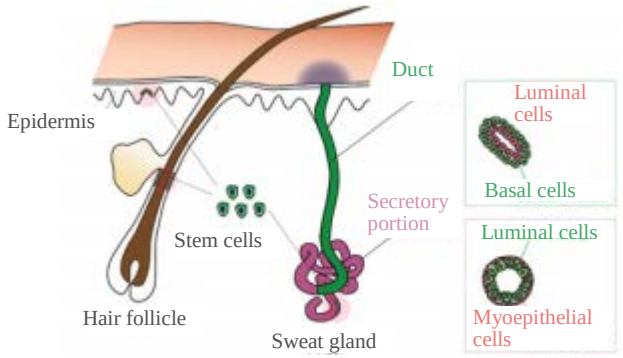

Figure 2: Identifying Markers that Exclusively Distinguish Sweat Gland Components

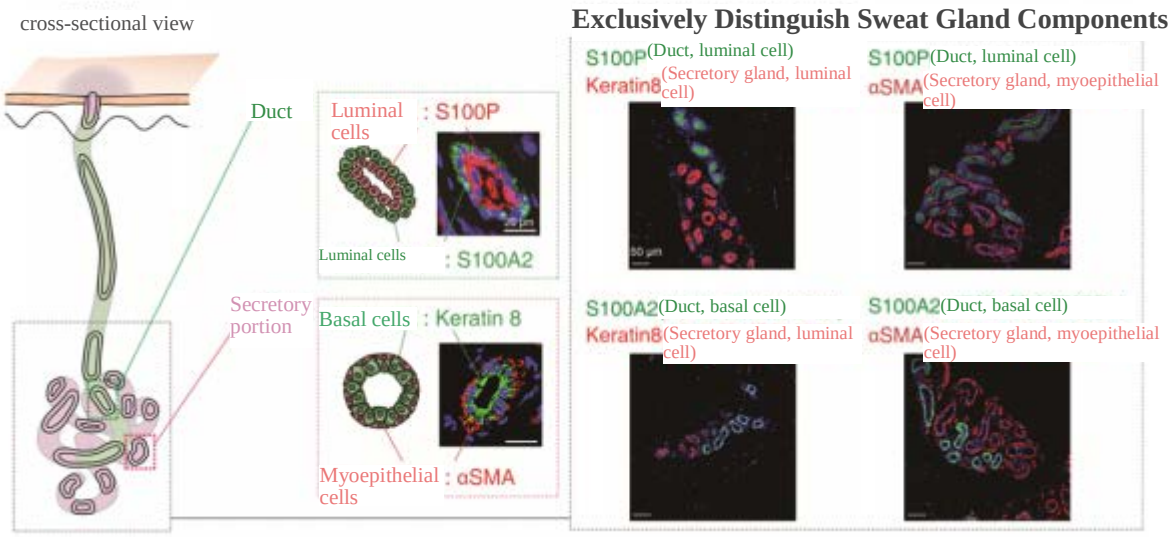

Figure 3: Isolation of Myoepithelial Cells and Luminal Cells from a Secretory Gland by using αSMA and Keratin8

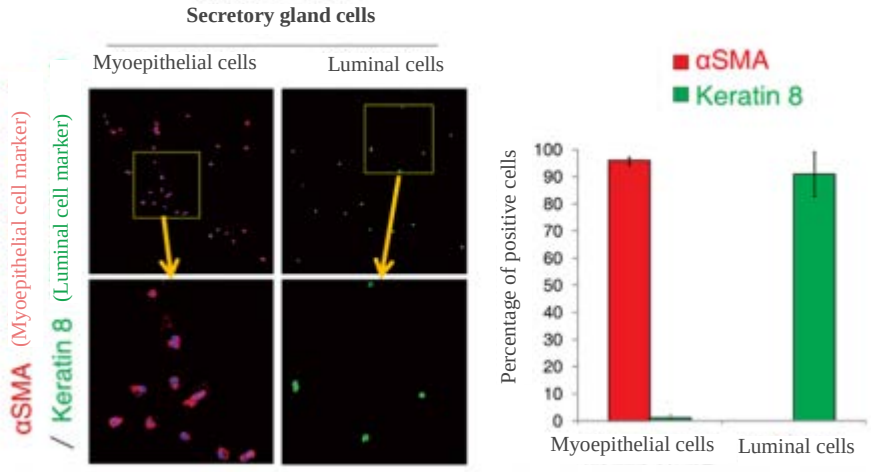

Figure 4: Stem Cell Characteristics of Myoepithelial Cells (Pluripotency and Self-replication)

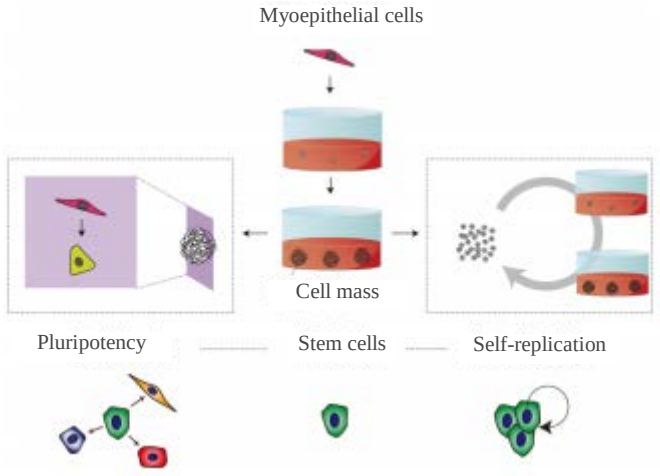

Figure 5: Sweat Gland-like Structure Replicated from the Sweat Gland Stem Cells