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The beauty of mink pelage observed with SEM*

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Introduction

Mink skin is very popular among all the people in the world as the beautiful and warm clothing. Much effort has been expended to improve the quality of this beautiful skin.

It is well known that hairs in almost all mammals emerge from an orifice of skin surface as a group. The group is called a hair bundle or a hair follicle group. Maurel et al.[6] reported on the differences of hair bundles among three fur bearing mammals. Hair morphology has been well studied under a light microscope, especially the variety of hair bundles, by Blomstedt[1,2,3]. However, there are few reports on the hair bundle observed with SEM.

This study was performed to illustrate the morphological structure of mink pelage through the observation with SEM.

Materials and Methods

Male dark mink in Telogen was sacrificed in early December and then an approximately 5 by 5 skin sample was taken from their dorsal region. After degreasing with a neutral soap for 60 min, the skin samples were washed in 10% sodium chloride for 24 hours at room temperature to remove the soluble proteins. After that they were fixed by 2.5% gultaraldehyde. They were then washed in several changes in distilled water and frozen. The specimens for the observations of hair bundles were sliced perpendicularly to their backbone from frozen samples with a razor. Then they were dehydrated through graded concentrations of ethanol, transferred to tert-butyl alcohol and freeze-dried (Figure 1).

Observations of the medulla in hair by SEM were made on specimens prepared as follows. Firstly, the hairs were attached to standard brass standard stubs with scotch tape and then cut with a new razor blade along the axis of the

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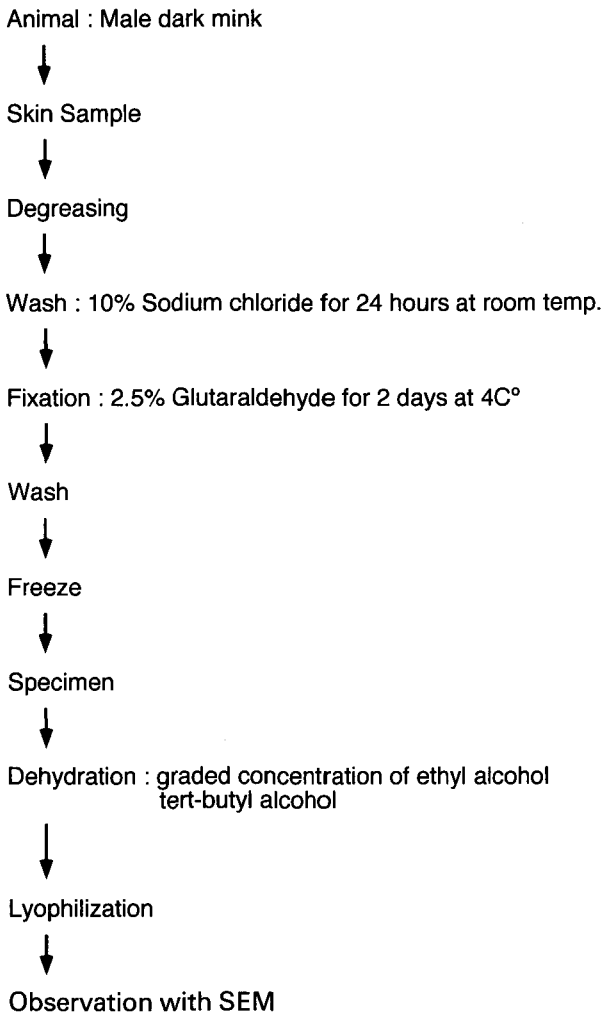

Fig. 1. Preparation of sample for the observation of hair bundle

fiber under a stereomicroscope[5].

The outermost features of hair shaft were observed with SEM on both guard hair and underfur attached to brass standard stubs coated with a manicure liquid.

All the sample for the observation was sputter-coated with gold. Observations were made with a JSM-T20 scanning electron microscope operated at 19 kV.

Results and Discussion

Variety of hair bundles

In these studies the hair bundles were observed with SEM (Figure 2, Aand B). In specimens sliced perpendicularly to back bone, it was possible to observe the

hair bundles from the upper to the deep positions in dermis. The hair bundle surrounded by connective tissue sheath (Cs in Figure 2) was more clearly seen in the upper layer located between skin surface and upper end of follicle than in more profound layer of dermis. A in Figure 2 shows the hair bundle composed of straight guard hair and underfur. B in Figure 2 shows the hair bundle composed of only underfur. In Figure 2 the hair within bundles were round in shape and without medulla. It was considered from the above observations that the fur skins observed in Figure 2 were prime, i.e. telogen phase of the hair growth cycle in mink.

Outermost features of hair shaft

The outermost features of hair shaft with SEM are shown in Figure 3.

The tip region of underfur resembled a fishing rod with jointed parts and the pointed head showed a needle-like shape (Figure 3-A). The rest of the underfur below the tip region (Figure 3-B) was surrounded with cells lanceolate in form[6].

The scale patterns of guard hair showed many variations along the length of the fiber, from tip to root. The tip region (Figure 3-C) showed a stick-like form, different from that of underfur which had a needle-like form. The scale margins display a distinct rippling wave form. From the tip to the thickest region, the patterns of scale margins changed to a distinct mosaic form (Figure 3-D). The thicker region, lanceolate in cross section[4], showed a close irregular wave (Figure 3-E). In the root region, the scale patterns exhibited a pectinate-like form from wide to thin. (Figure 3-F, G)

Hair medulla

A longitudinal section of guard hair and underfur is shown in Figure 4. Medulla of guard hair displayed a fine, complex wall interspersed irregularly with air spaces (Figure 4-A). The shape characterized through SEM is very different from that examined under a light microscope. The complex air spaces may contribute to insulation by preventing air circulation. While the shape of medulla of underfur was different from that of the guard hair, it showed a ladder form, which is same as seen in other mammals. However, the SEM revealed granular materials on the ladder (Figure 4-B), which have not been observed under a light microscope. When magnifying them 7,500 times, it was observed that some of ladders were mainly composed of melanin granules (Figure 4-C).

Summary

This study was done to seek the morphological structure of mink pelage in telogen through the observation with a scanning electron microscope. Hair bundle was observed clearly and beautifully at the position between the skin surface and the upper end of hair follicle. The structure of hair medulla and hair cuticle was observed more in details by using SEM than under a light microscope. The

morphological structure of mink pelage through SEM is considered to be natural arts.

Acknowledgements

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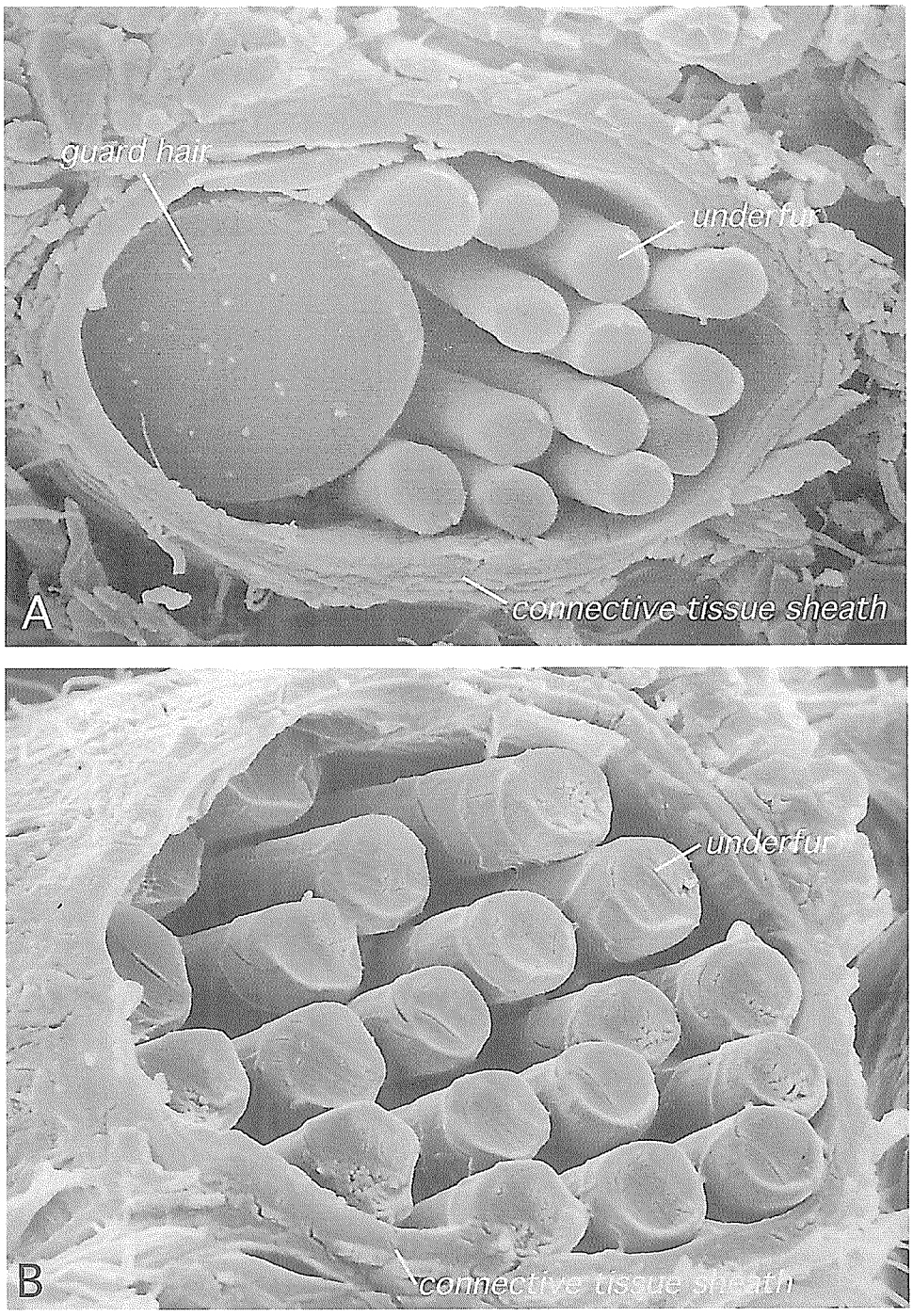


Fig. 2. SEM features of hair bundle
A : Hair bundle composed of guard hair and underfur X1,000
B : Hair bundle composed of only underfur X1,500

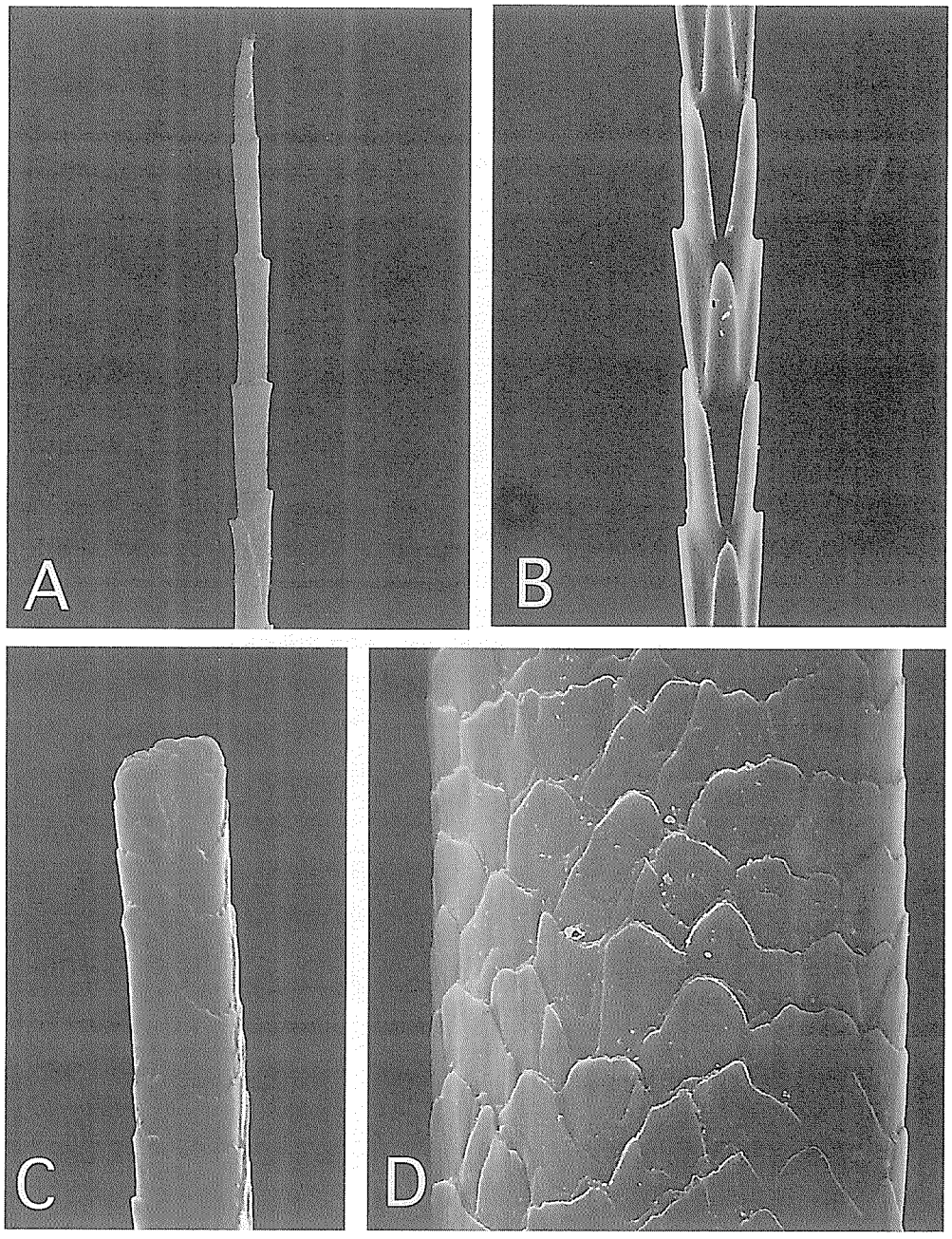
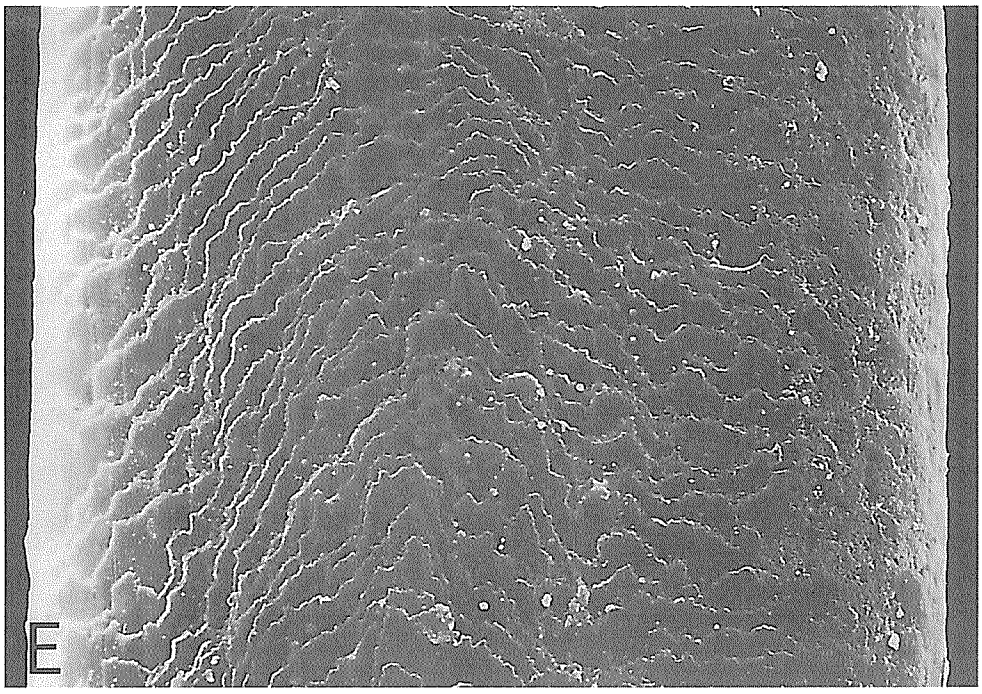


Fig. 3. SEM features of outermost form
A : Tip of underfur, B : Major part of underfur except tip region, C : Tip region of guard hair, D : Upper part in thick region of guard hair, E : Mid part in thick region of guard hair, F : Lower part in thick region of guard hair, G : Root region of guard hair
A : X2,000, C : X2,000, B&D-G : X750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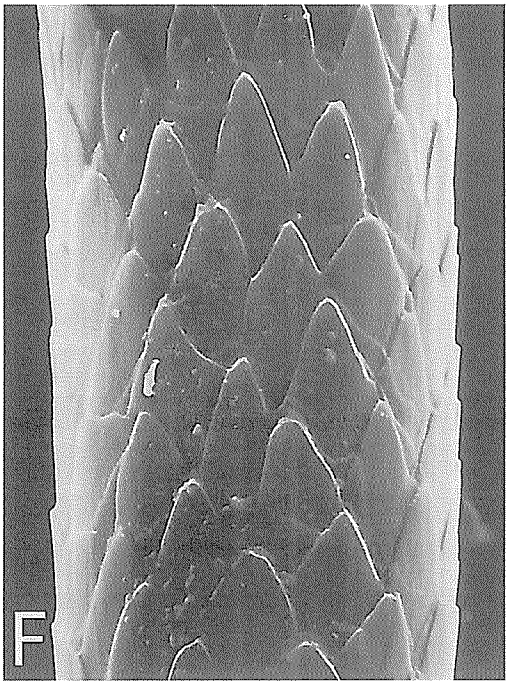
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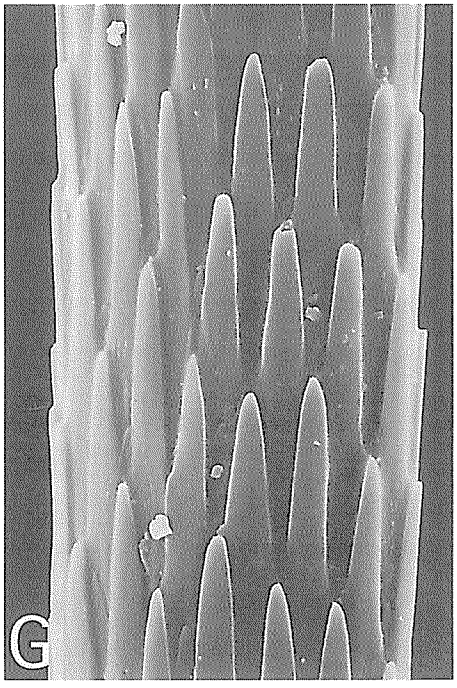
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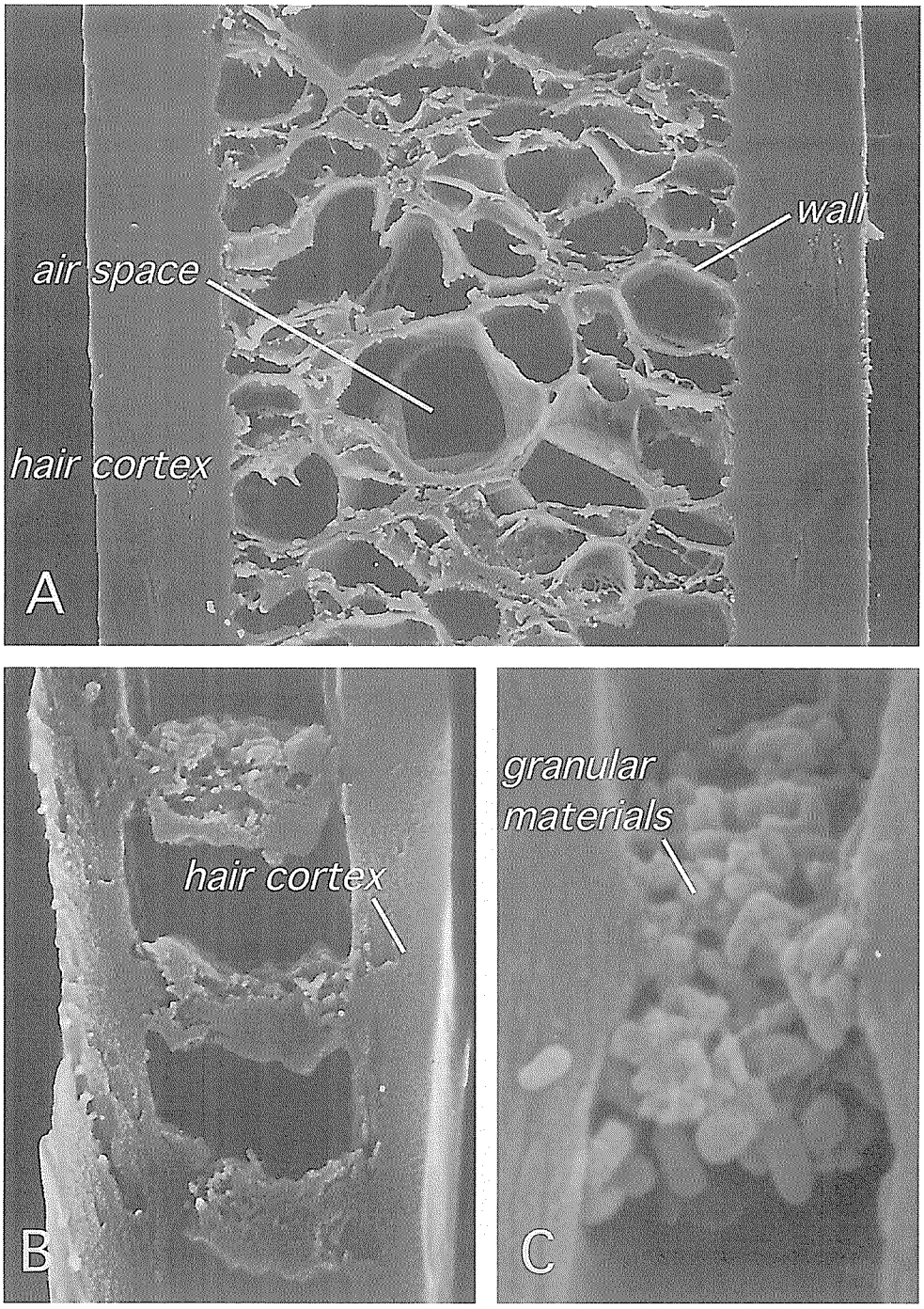

Fig. 4. SEM features of hair medulla in mink
A : Guard hair X750, B : Underfux X3,500, C : Underfux X7,500