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EYELASHES, NOT LIKE OTHER HAIR

Compared to hair and hair follicles, relatively little is known about the eyelash. Cosmetics however is taking an increasing interest in eyelashes and the differences according to population origins.

Eyelids and eyelashes protect the eye from foreign bodies and help to keep the surface of the cornea moist. Eyelashes are implanted in 2 to 4 rows along the edge of each eyelid. The upper eyelid contains longer (8-12 mm) and more numerous lashes (from 90 to 160) than the lower lid which only has 75 to 80 lashes, from 6 to 8 mm long.

Often varied lashes

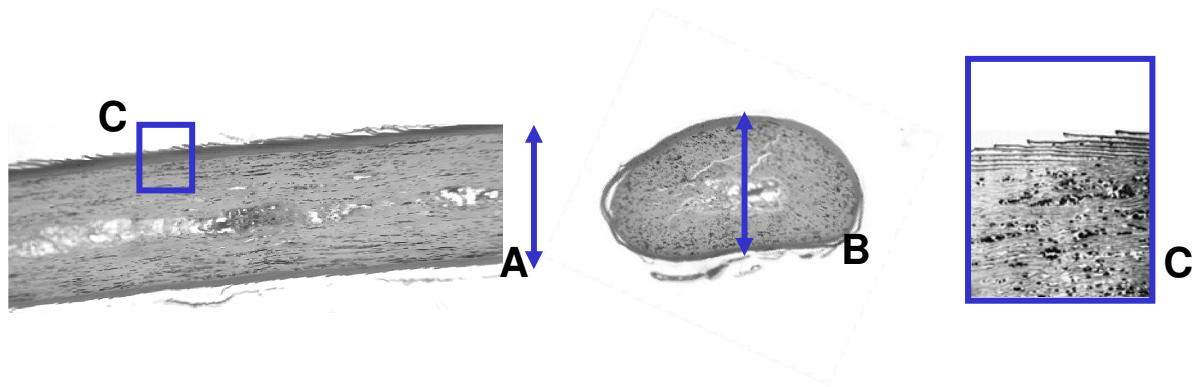
An international study was conducted by L'Oréal on 4 groups of women: Americans of African origin, Caucasians from the United States and France, and Japanese. During the exploratory phase, all the expressions used by the women to describe their eyelashes were noted and classified. In the subsequent quantitative phase, the essential parameters were identified to construct a typology for each population into 5 groups of eyelashes. Depending on the case, there is a wide diversity of lashes in terms of volume, the number of lashes, their length and curvature.

Caucasians France 18-65 years	Caucasians USA 18-65 years		Afro-Americans USA 18-65 years	Japanese 18-65 years
		★ ★ ★ ★ ★		
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What is an eyelash?

The eyelash is a regular **fiber** more or less curved depending on its origin. Imaging of the lash by Transmission Electron Microscopy (TEM) reveals a structure that is very similar to the hair, with the same compartments: a cuticle (with 7 layers of cells on average), a cortex containing melanin pigments, and a medulla (**1a**, **2** and **3**).

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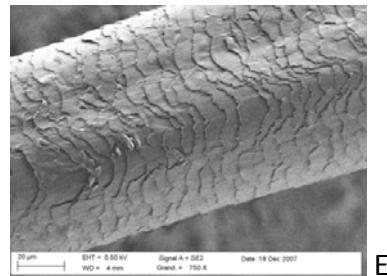
TEM images of an eyelash

A. Longitudinal section of a lash B. Transversal section according to the axis
C. High density of melanin grains

Scanning Electron Microscopy (SEM) had shown previously that the diameter varied along the length of the fiber: 70-80 μm near the root, 80-120 μm in the central part and 5-10 μm at the tip. Such variations had also been described for the human hair (1 b).



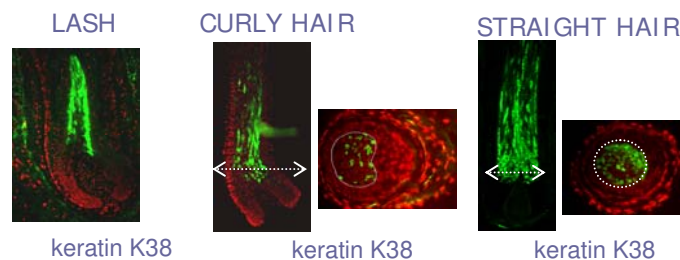
D. SEM image of a lash tip



E. SEM image of the base of a lash

In 2006, Na et al (6) compared Caucasian and Asian lashes using the scanning electron microscope and found no differences of surface. However, they did note that the density of the **cuticle** (average number of layers of cells per 100 μm) was significantly greater in Asian women. In the same way, they noted that the thickness of the cuticle was also greater in Asian women. For this reason, the Asian lashes are thicker and straighter, just like Asian hair.

According to the literature, Asian lashes, and Japanese ones in particular, are planted at an average angle of about 17.2° . Scientists at L'Oréal delved further by studying the curvature of the lash follicle. They showed that the asymmetry of the lash bulb generated a curved fiber (5 and 7) and that the differentiation in the cuticle and the cortex were also asymmetrical, as was the case in curly hair.



Two populations of melanocytes were detected in the hair follicle: the first are melanocyte producers at rest located in the upper part of the external sheath, and the second are found in the active part

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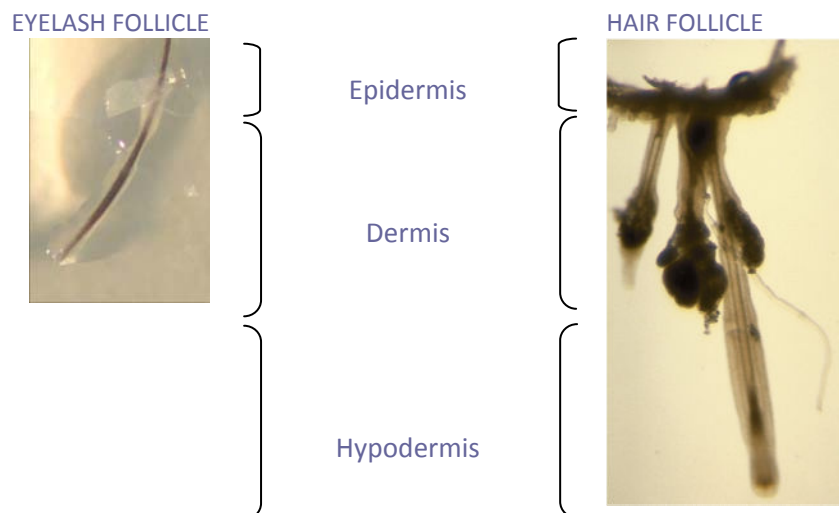
of the bulb's **pigmentation** unit (2). Whitening of the hair is due to a gradual drop in these two populations of melanocytes (3 and 4). One of the main causes of this phenomenon is the absence of the expression of TRP-2, an enzyme involved in melanogenesis and which also protects cells (8).

In the lash, melanocytes are numerous in the basal layer of the eyelid's epidermis. They are particularly numerous in the external sheath, the pigmentation unit and even in the matrix of the lash follicle. Tyrosinase and TRP-1 have also been detected in the pigmentation unit, but not in the external sheath. Moreover, and contrary to what is observed in the scalp, TRP-2 is largely expressed in the melanocytes, whether they are active or dormant. In general, lashes do not whiten, probably due to the cell protection activity of TRP-2.

Cross-sections of eyelids show skin that is thinner and an absence of hypodermis. The lash follicles are **implanted** about 2mm in the dermis contrary to hair, which is deeply anchored in the dermis (4mm). In Asian people, the lash seems shorter but the differences are not statistically significant. They look shorter but this may be due to the morphology of the upper eyelid.

Contrary to hair, the eyelashes are not associated with an arrector pili muscle. However, they are connected to several ancillary glands. There are almost 50 in the upper eyelid and 25 in the lower eyelid. Firstly, the Moll glands (sweat glands) and the **Zeis glands**, simple sebaceous glands attached to the eyelash follicle and located at the edge of the eyelid that produce an oily substance. Then, separately from the eyelash follicles, the **Meibomius glands** that secrete *meibum* (fatty acid comprised of triglycerides) and making up the basis of tear film. They enable the eye to be open for a certain time without breaking the tear film. The first are named after the ophthalmologist Eduard Zeis, the second after the German doctor Heinrich Meibom who discovered them.

The **structure** of the eyelash fiber is very close to that of the hair, but the associated biological processes diverge considerably (curvature, color, length). The thinness of the epidermis, the (short) length of the lashes and the absence of hypodermis are undoubtedly one of the causes.

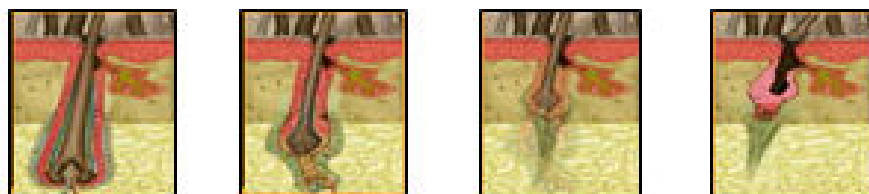


Follicle dynamics

The life cycle of the eyelash is more dynamic than that of the hair. The length of the lash's growth phase, during which the eyelash reaches its maximum length of 7 to 8 mm, varies from 1 to 3 months depending on the author, but there are no data according to age, sex or geographical origin.

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This anagen phase is much longer for hair, almost 3 years, which explains the length of hair. However, the rest phase, during which the follicle does not grow, lasts from 2 to 4 months for the eyelash and from 3 to 6 months for the hair.



The hair's growth cycle

	EYELASH	HAIR
Length of the growth phase	1 - 3 months	3 years
Length of the rest phase	2 - 4 months	3 - 6 months
% of follicles in the growth phase	15%	85%

This **very rapid renewal** is a very interesting parameter when its growth is studied. However, as the eyelash is so close to the eye, the greatest precaution is necessary when studying active ingredients.

Much remains to be studied and discovered in the variability of the eyelash cycle, and in the growth parameters according to origins or to the age of the populations studied.

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