Why measure the impact of cosmetic products on the scalp microbiome? by Byome Labs via FOCUS#13

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Composition and role of the scalp microbiome:

A balanced and diverse microbiome is essential for maintaining a healthy scalp: it supports the skin's barrier function, acts as protection against colonization by pathogens, and helps preserve the integrity of the skin (1,2).

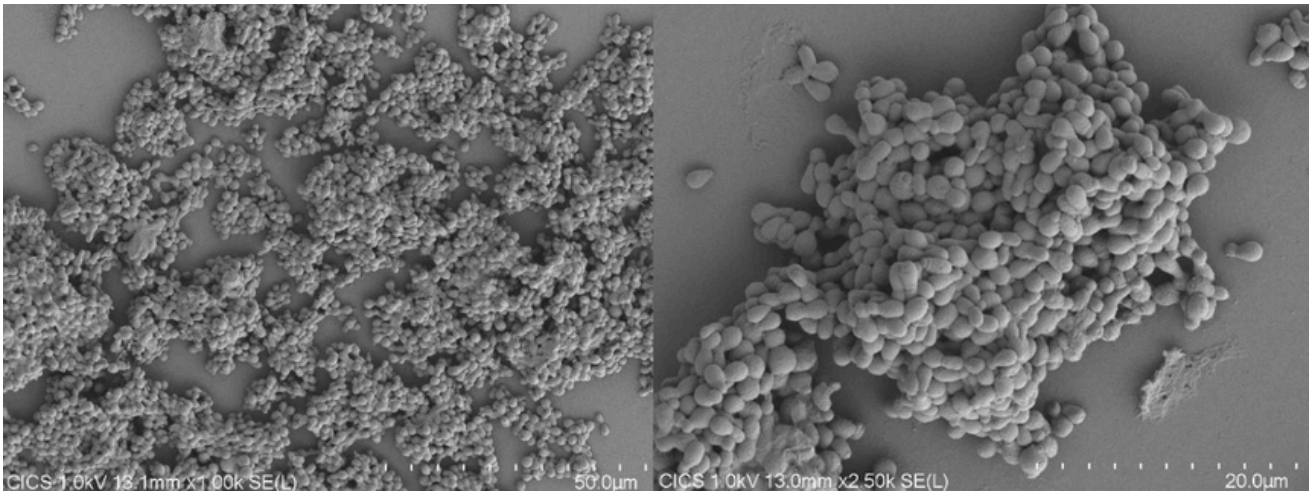
The scalp microbiome is dominated by commensal bacteria and fungi, the most representative of which are: (1,3–5)

• Bacteria of the genus *Cutibacterium*: these anaerobic bacteria, particularly *Cutibacterium acnes*, play a role in regulating sebum and maintaining skin balance.

• Bacteria of the genus *Staphylococcus: Staphylococcus epidermidis* has beneficial effects, including protection against pathogens, while *Staphylococcus aureus*, found in higher proportions in certain scalp conditions, can become problematic.

• In terms of fungal commensals, *Malassezia* yeasts (particularly *M. restricta* and *M. globosa)* are very abundant on the scalp. These lipophilic fungi dominate the fungal flora of the scalp. They break down triglycerides from sebum into fatty acids, but if they become overrepresented or under specific conditions, they can cause inflammation and irritation of the scalp.

Scanning electron microscope images of a M. restricta *biofilm produced by BYOME LABS*



Dysbiosis of the scalp microbiome:

A disturbed scalp microbiome (dysbiosis) is clinically correlated with a sensitive scalp and is physiologically characterized by excess sebum. Overall, a disturbed balance of resident skin microorganisms is correlated with inflammatory disorders and skin infections (1).

• Cases Dandruff and seborrheic dermatitis

Dandruff and seborrheic dermatitis are part of the same disorder, which varies only in its location and severity. Dandruff is a common scalp condition affecting approximately 50% of the world's population. It is characterized by itching and flaky skin with white or yellowish scales (8).

An excess of *Malassezia spp.* (particularly *M. restricta*) and the oxidation of squalene on the scalp have been linked to dandruff and seborrheic dermatitis. This is thought to be partly related to reactive oxygen species (ROS) produced by *Malassezia spp.*, which can damage emerging hair follicles (1,8).

The impact of dysbiosis on the alteration of the epidermal barrier function, as well as on the triggering of inflammation, is not yet fully understood. However, it is accepted that restoring the skin's microbial flora by increasing the amounts of protective microorganisms and reducing the amounts of potential pathogens can help rebuild the skin barrier (8).

• Cases of alopecia

Alopecia is common and can severely affect quality of life, both medically and psychologically. Its cause remains unknown. However, the condition of the scalp skin and hair quality are recognized as risk factors involved in its pathogenesis (5).

In a 2022 clinical study on the composition of the scalp microbiome in patients with alopecia areata, a significantly higher proportion of *Corynebacterium* species and a lower proportion of *Staphylococcus* species were observed in subjects with severe alopecia areata compared to healthy controls and subjects with mild forms of the condition (9). This is logical since the ecological niches conducive to the development of lipophilic microorganisms (*Cutibacterium* and *Malassezia*) are absent.

Factors influencing the scalp microbiome:

The balance of the scalp microbiome can be affected by a combination of factors. Intrinsic determinants (age, gender, diet, genetics) and extrinsic factors (pollution, UV radiation, cosmetics) modulate its composition (1).

BYOME LABS' expertise:

We support cosmetic, dermo-cosmetic, and pharmaceutical brands with robust in vitro tests based on culturomics approaches to evaluate the effect of finished products and ingredients (all galenic forms) on microorganisms representative of the scalp microbiome. Nearly 20 years of expertise have enabled us to develop true mastery in the cultivation of demanding microorganisms.

We have developed specific culture media that now enable us to characterize Malassezia spp. in planktonic and biofilm conditions.

These models are particularly relevant for measuring the impact of your product on *Malassezia spp.* imbalances in scalp dysbiosis. Our models are based on the latest scientific data to design relevant contexts, including dandruff/seborrheic dermatitis, sensitive and unbalanced scalp, with artificial sebum addition.

What we deliver: clear results that provide scientific evidence for your claims (anti-dandruff and preserves scalp balance for example), whether demonstrating preventive or corrective action or the preservation of microbial homeostasis.

Our goal: to transform your promise into scientific evidence that can be used for both marketing and regulatory purposes.

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