

Perfecting properties of a marine exopolysaccharide

Perfect skin - new skin - skin as fresh and radiant as a baby's is achieved through a multi-faceted approach. Skin colour, shine, surface condition and texture are all factors which play a role. To respond effectively, a comprehensive strategy is needed; the three major skin functions must be rebooted: physical barrier function, chemical barrier function, and hydra memory function. This reboot involves readjustment of the four parameters of 'good' skin health as innate immunity, skin renewal, chronic inflammation and rehydration.

Working on the development of original molecules through blue biotechnologies, Codif's laboratories have discovered a marine exopolysaccharide, mainly composed of galactose, and *N*-acetylglucosamine (Fig. 1), and which has been demonstrated to have a multi-faceted approach to the good health of skin as well as for its perfecting of the surface aspect.

Rebooting the physical barrier function

Disorganisation of the skin's physical barrier leads to skin dehydration and increased skin roughness; it also causes a loss of skin radiance (dull complexion). An impaired skin barrier also facilitates contact with allergens and the development of unwanted bacterial flora. Keratinocyte

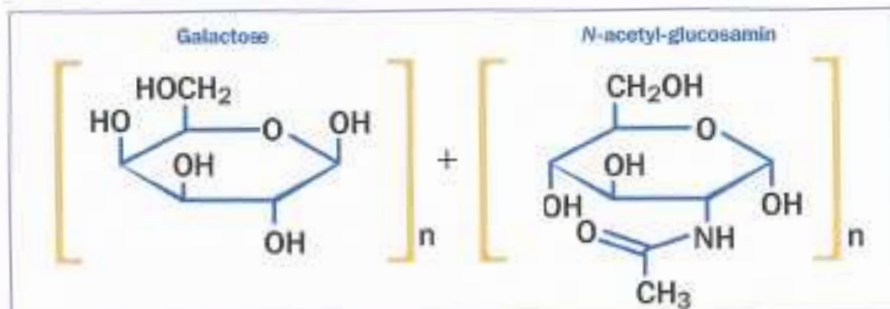


Figure 1: Composition of the exopolysaccharide Epidermist 4.0.

differentiation and epidermis renewal are the two main mechanisms affecting physical barrier quality.

The primary function of the epidermis is to produce the stratum corneum which forms a semi-permeable protective layer. It is formed through the differentiation of keratinocytes from the basal layer to the skin's surface layer. Many proteins and enzymes are involved at each stage of keratinocyte differentiation. Among them, nine are stimulated by Epidermist 4.0 used at 1% on reconstituted human epidermis: involucrine (+250%), transglutaminase 1 (+130%); small proline rich protein: SPRP1A (+750%), SPRP1B (+490%), SPRP 2A (+510%); late cornified envelop protein LCE3D (+1380%), LCE2B (+60%); comeodesmosine (+260%) and NICE-1 protein (+1911%).

This improvement of keratinocytes differentiation is coupled with an increase in skin renewal rate. Tested at 1% on 17 volunteers, Epidermist 4.0 increases the cell renewal rate by 100% in just one week (Fig. 2). Both actions will promote better epidermal cohesion and better elimination of dead skin cells and skin roughness. By rebooting the skin's physical barrier, Epidermist 4.0 (now referred to as 'the new skin builder') provides a smoothing and softening effect on skin texture, appreciated by the volunteers during clinical self-assessment.

Rebooting the chemical barrier function

The chemical barrier function brings two defence modules into play: innate immunity made up of proteins and antimicrobial peptides and inflammatory reaction. Innate immunity, unlike acquired immunity, is already present within a child when it is born. It is the first line of defence against the infectious agents and pathogens which surround us. Innate immunity is activated immediately after bacterial penetration, and works for four days.

Topically applied at 1% on human reconstituted epidermis, the new skin builder increases the synthesis of four antimicrobial peptides of innate immunity: defensin beta 103 (+1250%), secretory leucocyte peptidase inhibitor (+550%), ribonuclease RNase 7 (+430%) and S100 calcium binding proteins A10 (+380%).

These antimicrobial peptides, by deconstructing exogenous bacteria membranes, inhibiting bacterial elastases.

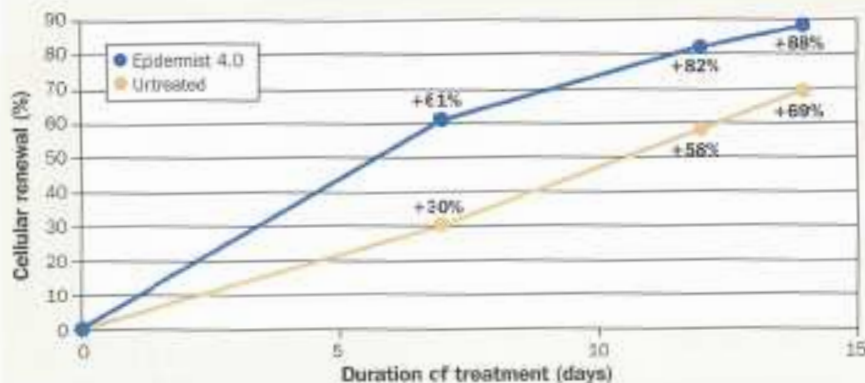


Figure 2: Clinical effect of 1% Epidermist 4.0 on skin renewal vs. untreated control. Application of a coloured cream containing 5% DHA, 1 day before start of treatment. Skin pigmentation by the DHA enables monitoring of cell renewal; pigmentation is eliminated faster when cell renewal activated.

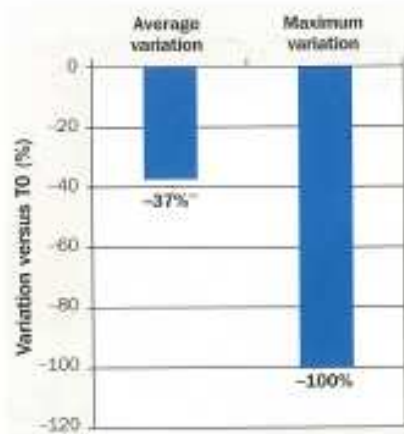


Figure 3: Variation of skin reactivity after 1 week of treatment with a gel containing 1% Epidermist 4.0, twice a day. Evaluation of skin reactivity score using stinging test. * $p < 0.01$ t-student's test.

and collagenases, and disturbing bacterial cell cycle will help to decrease bacterial growth at the surface of the skin and improve skin health.

In the meantime, the new skin builder, used at 1% on reconstituted human epidermis, decreases inflammatory mediators like S100 calcium binding protein A7 (-56%), also known as psoriasin, toll-like receptor 2 (-50%), TNF α (-66%) and chemokines CXCL5 (-35%) and CXCL10 (-74%).

This decrease in inflammatory mediators clinically results in a diminution of skin reactivity by 37% on average after one week only (Fig. 3). By reinforcing skin's innate immunity and reducing inflammation, the new skin builder improves skin health and decreases its reactivity.

Rebooting skin's hydra memory

Environmental attacks, chemical products, friction, etc., all play a daily role in drying out skin. Applying moisturising products helps to rehydrate damaged skin, but not all skin types recover their optimal hydration levels in the same way. This ability to recover optimal hydration levels can be called 'hydra memory'. It involves a mechanism of pumping water into the dermis to rehydrate the upper layers: epidermis and stratum corneum.

The skin's hydra memory will be all the more effective if the physical and chemical barrier functions perform well. This memory can also be improved by reinforcing the skin's ability to retain moisture, as does hyaluronic acid. This is the main component of dermis, acting like a water magnet to trap hydration molecules and gradually disseminate them to the skin's outer layers.

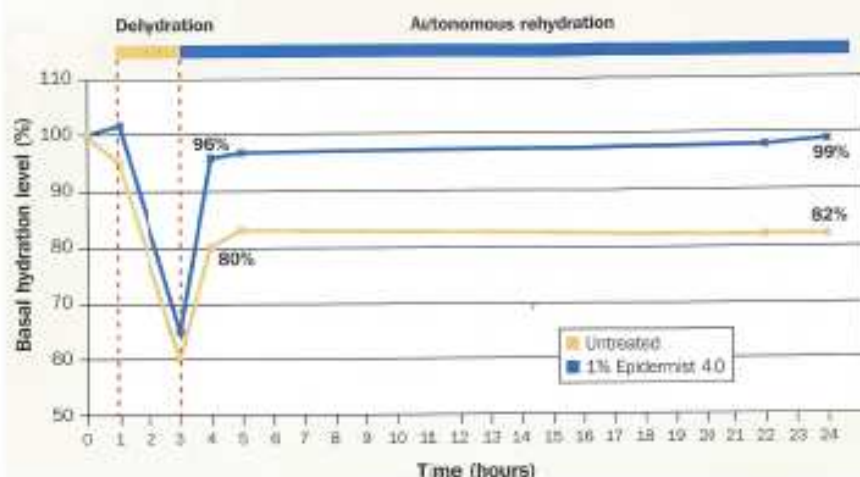


Figure 4: Evaluation of the capacity of skin explant pre-treated with 1% Epidermist 4.0 to autonomously regain (without added moisturiser) its optimal level of hydration after severely dehydrating stress (use of salt crystals). Hydration levels are measured using corneometry.

By stimulating hyaluronic acid synthesis by 66%, in cultures of human fibroblasts, the new skin builder helps the skin to rehydrate autonomously after dehydrating stress. Indeed, skin explants topically treated with the new skin builder and then exposed to dehydrating crystal salt recover 96% of their hydration level one hour after dehydration treatment, vs. 80% only for an untreated epidermis (Fig. 4).

Global perfecting action

Skin renewal is about regaining soft, brighter skin with smoothed skin texture and less visible pores – skin that looks renewed and in good health. The use of a tool called Visa Skin Complexion Analysis allows us to visualise the effect of the new skin builder on skin roughness and texture; bacterial growth through porphyrin quantification; a bacterial shedding characteristic among other *Propionibacterium acnes* which is easy to quantify because it turns fluorescent under

UV; and then pore visibility and surface area (Fig. 5).

After one month of twice daily application of the new skin builder at 1%, we observe an average decrease of porphyrin (and thus bacterial growth) of 10% and up to 54%, an average decrease in skin roughness of 19% and up to 56%, an average decrease in pore visibility of 7% and up to 41%, and an average decrease in the total surface of visible pores of 11% and up to 58%.

Conclusion

Thanks to its multi-faceted approach, Epidermist 4.0 provides skin with an overall perfecting action. It smoothes rough skins, decreases bacterial growth to reduce acne characteristics, decreases visible pores for mature and acneic skins and reboots the water memory function to improve the comfort levels of mature and reactive skin types, and also resolves the issue of skin dryness in oily, acne-prone skin types. **PO**

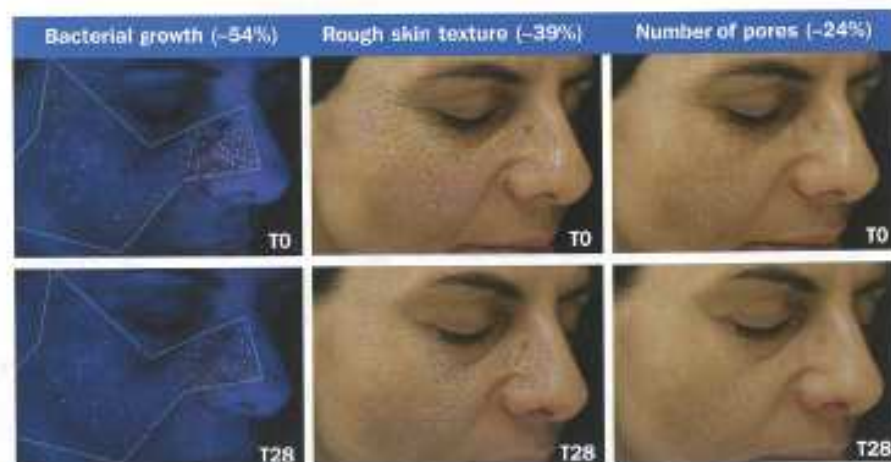


Figure 5: Overall view of the effect of Epidermist 4.0 on a volunteer. Visualisation of bacterial growth (fluorescent spots), skin texture and roughness (blue lines and yellow spots) and number of visible pores (green spots) thanks to the tool VISIA.