

Skin, Brain & Emotions

Towards new perspectives

How can we dissociate the epidermis from the brain once we realize their common embryonic origin? The latest advances in neuroscience place epidermal keratinocytes at the forefront of sensory systems, knowing that the hormones and the neurotransmitters they generate influence whole-body states and even emotions⁽¹⁾.

That explains why, beyond the simple improvement of skin parameters, advanced research in cosmetics aims to understand in more detail the impact of topical products on the consumer's emotional state.

The "brain-skin axis"

The skin displays many neurotransmitters and neuropeptide receptors expressed by the central nervous system, whilst epidermal keratinocytes contain sensors of mechanical stress, temperature and chemical stimuli. Moreover, all the components of the hypothalamo-pituitary-adrenal (HPA) axis appear to be present in epidermal keratinocytes⁽²⁾, suggesting that the epidermis plays an important role in regulating whole-body physiology, and probably emotional response, to changing environments. In addition to its protective role, the epidermis thus also appears to serve as a sophisticated, "brain-like" interface between our body and the environment.

Human Beauty & the Brain

The perception of our own image as well as the appearance of others is also very dependent on our brain and our emotions: by placing physical appearance in the context of biology, evolutionary pressures shape the neuroscience of human beauty. Phenotypes that directly improve the chances of reproduction, such as attracting mates, are under stronger selection pressure since they directly influence the frequency with which those genes are passed to the next generation⁽³⁾.

From this perspective, the human brain has acquired the ability to choose the heal-

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thier partner by analyzing the physical characteristics to judge facial attractiveness and symmetry⁽⁴⁾. This involves at least three modules, composed of interconnected brain regions, to judge facial attractiveness: one for identification, one for interpretation and one for assessment through neurological rewards with neurotransmitters and associated emotions⁽⁵⁾.

That is why the cosmetics industry is currently entering the emotional era, searching for more rationality to substantiate arguments about skin beauty and emotions and these insights pave the way for the development of "emotional beauty" enhancers. Keen to offer multifunctional ingredients that can keep up with this challenge and follow the "healthy aging" trend, Seqens Cosmetics has developed cosmetic ingredients that not only improve skin appearance but that are also likely to improve well-being.

Emotional-beauty-enhancers

Among others, Seqens focused on deciphering very high-molecular-weight exopolysaccharides according to two dimensions:

- an active dimension: by characterizing the 3D patterns present at the core of these macro-structures, which have an affinity for key skin structures.



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- an emotional dimension: by measuring their ability to significantly improve self-perception on volunteers vs. placebo.

These new approaches put the spotlight on an EPS, Glycuron 2.78, which, among other giant polysaccharides, represented a candidate with very high potential as an *emotional-beauty-enhancer* active ingredient.

Methodology: from sugar deciphering to emotional measurements

Exopolysaccharide identification and characterization

After characterizing microbiota of certain marine species such as sea anemones (*Actiniaria*), a strain of *Alteromonas sp* was identified, capable of synthesizing a high molecular weight exopolysaccharide (Glycuron 2.78) of more than 4. 10⁶ Da, with a very low dispersity index. The selected exopolysaccharide is rich in uronic acids and has been analyzed in detail by RMN, GC, High pressure Size Exclusion Chromatography (HPSEC) as well as Fourier-transform infrared spectroscopy (FTIR).

Glycoprofiling: sugar-protein interaction study

Since the molecular structure of sugars is not predictive of biological effectiveness, the lectin array technology of Glycoprofiling (Glycodiag) is used to obtain the interaction profile of this EPS with a range of lectins. This approach allows us to decipher a signature and the potential associated biological activities that are unique to this exopolysaccharide.

For this study carried out on 20 lectins, the products are unlabeled, so interaction profiles are determined through an indirect method based on the inhibition of the interaction between a specific lectin-glycan couple by the sample. For each product, the inhibition profile is determined at 3 concentrations and the analysis is repeated twice in an independent manner. Glycan structures such as polysaccharides, glycoconjugates or proteoglycans have critical roles at the cutaneous level in communication and recognition processes such

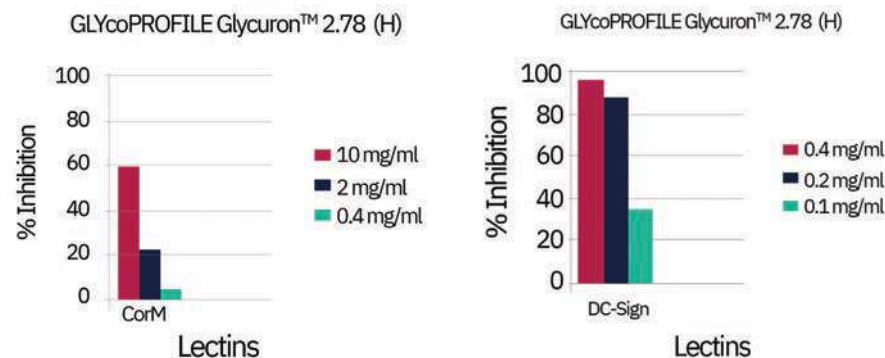


Figure 1: Glycoprofile obtained with Glycuron 2.78

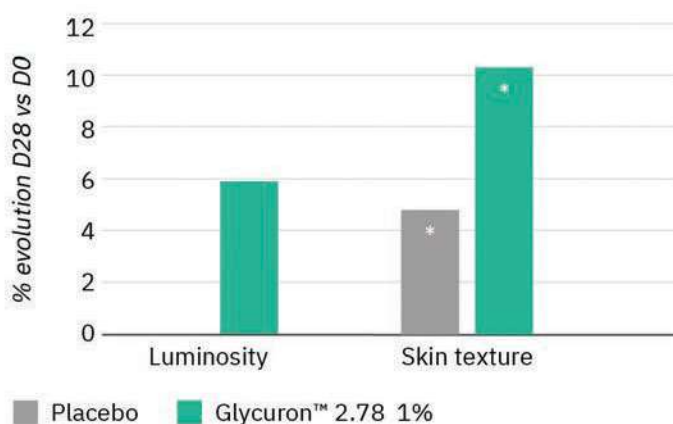


Figure 2: Results on skin luminosity and skin texture after 28 days of treatment (1% Glycuron 2.78) versus placebo. * p<0.05 significantly different versus D0.

as cell-matrix interactions or skin repair. These glycobiological interactions drive key biological mechanisms through the expression of specific glycans, playing the role of “glycobiomarkers” which allow modifications of their recognition by specific glycan “receptors” (lectins, lectin-like, glycosidases, glycosyltransferases).

Clinical study of skin parameters and emotional benefits

A double blind study was carried out on 45 Caucasian volunteers, from 46 to 60 years old, with dull skin and an uneven complexion. Two groups applied products, twice a day for 28 days: one group with the placebo cream (group A) and one group with 1% of Glycuron 2.78 (group B). The measurements were carried out at D0 and D28. Skin brightness was measured by an expert using an analogical scale 1 to 10. Concerning the study of the emotional impact provided by a cosmetic ingredient, Seqens cosmetics chose to work with the

tools developed by Emospin, using a combination of parameters associated with:

- Prosody: vocal parameters conveying emotional information such as intensity or pitch
- Verbatim: lexical field spontaneously used by the volunteers

Results are expressed versus placebo after 28 days of treatment with Glycuron 2.78 at 1% versus placebo.

Results: Improving skin appearance and self-esteem

Sugar-protein interactions of Glycuron 2.78 with key cutaneous lectins

The Glycoprofiling study based on lectin array technology enabled the deciphering of a “glycan signature” which is unique to each exopolysaccharide. This Glycoprofile highlighted interactions with lectins that usually recognize mannose, glucose, galacturonic acid and glucuronic acid. Since mannose mimics are accessible for

glycobiological interactions, Glycuron 2.78 is likely to interact with human C-type lectins, such as CorM, involved in dermal and epidermal regeneration as well as DC-SIGN, which plays a role in immunomodulation (Figure 1). Moreover, this ingredient also shows a specific interaction with rhamnose-specific lectins, which are known to be involved in cellular and epidermal regeneration.

Clinical improvement of skin parameters and self-esteem

These glycobiological predictions enabled us to design an *in vivo* study to highlight the potential consumer benefits of this exopolysaccharide, such as improving skin luminosity and texture for the group treated with Glycuron 2.78 at 1% *versus* placebo (Figure 2).

An additional evaluation of the emotional impact generated by those improvements through a self-perception assessment also highlighted significant effects regarding physical self-acceptance and self-appreciation. A significant improvement of the emotional state and an evolution towards a more optimistic, more positive lexical universe is observed in the group of volunteers treated with Glycuron 2.78 (at 1%) *versus* placebo.

Indeed, statistical analyses reveal that this decrease in emotional load when subjects are confronted to their reflection in the mirror is significantly greater on volunteers of group B, with Glycuron 2.78 treatment compared to the placebo group (A) for pitch and loudness (Figure 3).

Regarding verbatim and specific verbal content (i.e. statistically significant specific terms), it appears that dominant vocabulary used at T28 is more positive than wording expressed at T0, especially for the group treated with Glycuron 2.78 at 1% *versus* placebo. These results indicate that the group with 28-days of EPS treatment were more self-appreciative compared to the placebo group.

Conclusion

The interdependence between emotions and our perception of our own image (self-perception) or the image we think we project to others (allo-perception) represents

Variable	n	Mean	SD	t	p
Evolution in pitch A	22	-2.360	6.957	1.869	0.069/+
Evolution in pitch B	23	-6.137	6.603		
Evolution in loudness A	22	-1.675	6.879	2.201	0.033/*
Evolution in loudness B	23	-5.945	6.126		

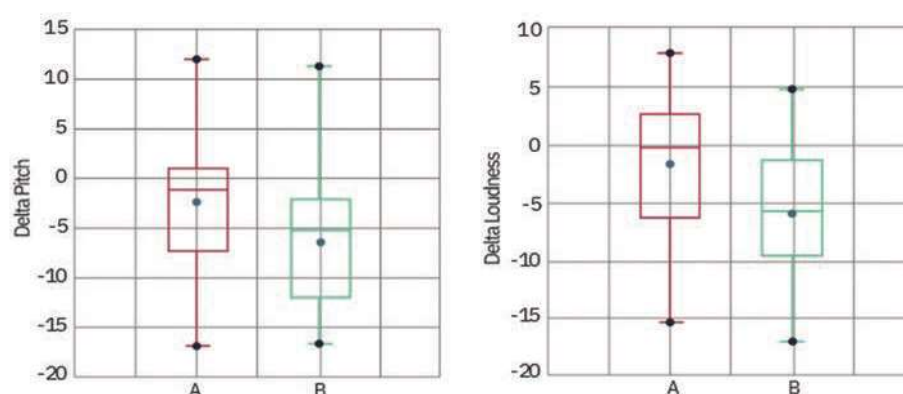


Figure 3: Results on Emotion with Prosody, Delta of pitch and loudness: group A (placebo) & group B (treated with Glycuron 2.78).

an essential study lever for the wellness industry. Up until now, the impact of a cosmetic product on our emotions has only been evaluated subjectively.

New methods to quantify this parameter by combining psychology with neuroscience allowed us to put the spotlight on the first cosmetic ingredient capable of improving, at the clinical level, both skin parameters and self-perception using a formula at 1% *versus* placebo. These results can be explained by the brain's ability to perceive very acutely certain changes in skin tissue and to amplify this signal with neurological rewards associated to improved self-esteem.

With this study, Seqens Cosmetics highlights the ability of a high molecular weight exopolysaccharide to provide a quantifiable benefit *versus* placebo by visibly enhancing the quality of the skin (luminosity, skin texture), but also the consumer's emotional state (prosody, verbatim) when they apply this ingredient at 1% in a formula.

This first success paves the way for characterized active ingredients specifically designed to enhance the perception of beauty and emphasizes the company's willingness and motivation to offer a generation of "emotional beauty enhancer" solutions ●

References

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