



# Brightenyl®

## Skin complexion biooptimizer

Brightenyl® is the very first cosmetic active ingredient that is activated by a new functional layer of the human skin: the stratum microbium™.

This new layer acts as an active living veil converting Brightenyl® in two molecules, which act on seven biological targets to obtain a perfect skin complexion.

### Skin complexion optimization: squaring the circle

All skin types may experience color and pigmentation disorders. These include discoloration marks, brown spots, redness as well as pigmented patches on skin. Uneven skin color and tone give an unhealthy, dull and tired appearance. The ideal look for healthy skin of any color is a clear even skin tone. Controlling the skin color, redness and reducing pigmentation require the use of different ingredients as these parameters rely on several different biological processes (vasodilation, inflammation, melanogenesis, coagulation of melanin, accumulation of UV-induced damages...).

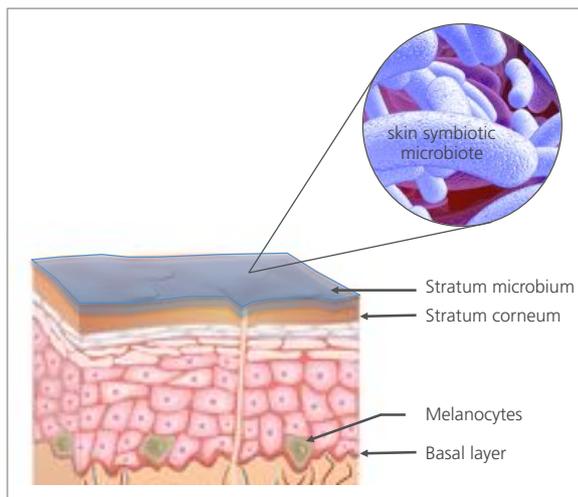
### *Stratum microbium™*: the discovery of a new active layer of human skin

Our body lives in symbiosis with massive amounts of beneficial microorganisms, which enable us to maintain our health on a daily basis. This micro-flora is called the human microbiote. It accounts for almost ten times as many cells as in the rest of our body, while representing orders of magnitude more genes than are contained in the human genome.

The human skin being the largest exposed organ, is also one of the largest microbial habitats. The human skin microbiote has a known symbiotic population from 100 to more than 10,000,000 cells per cm<sup>2</sup> depending on the body area<sup>1</sup>. The mutualistic interaction between humans and skin microflora is a result of long co-evolutionary processes involving the skin as the physical interface of our body with its outside environment. The traditional microbiology-based methods do not offer a full access and

<sup>1</sup> Mathieu et al., 2013, Research in Microbiology

understanding to our skin microbiote. It is estimated that 50 to 90% of existing skin microorganisms cannot be cultivated in a laboratory<sup>2</sup>. A recent high throughput DNA analysis technology (called metagenomics) has enabled us to gain a more exhaustive vision of the skin microbiote, and we are just beginning to understand the microorganisms' complex relationships with each other and our bodies in addition to the cosmetic products we apply to our skin. The skin microbiote (stratum microbium) is physically located on the top of our skin, in combination with the stratum corneum.



Induchem's R&D center, libragen, is one of the world's leading centers in the metagenomic technology. They have recently analyzed the human skin microbiote by sampling the superficial layers of the skin of volunteers, and sequencing the genomes of their stratum microbium. The analysis of 40 billions of DNA bases<sup>3</sup> has enabled to discover that our skin microbiote possesses genes of alpha-glucosidases, highly selective enzymes which could be used to activate cosmetic ingredients and increase their efficacy on the skin.

### Rational design of cosmetic ingredient to take benefits of the stratum microbium

Based on this fundamental discovery, the biotechnology researchers from induchem have created a new molecule called THBG: tri-hydroxy benzoic acid alpha glucoside (commercial name: Brigthenyl®). THBG is an alpha-glucoside derivative of THBA (tri-hydroxy benzoic acid), a known potent but highly unstable tyrosinase inhibitor. THBG is perfectly stable and highly water-soluble.

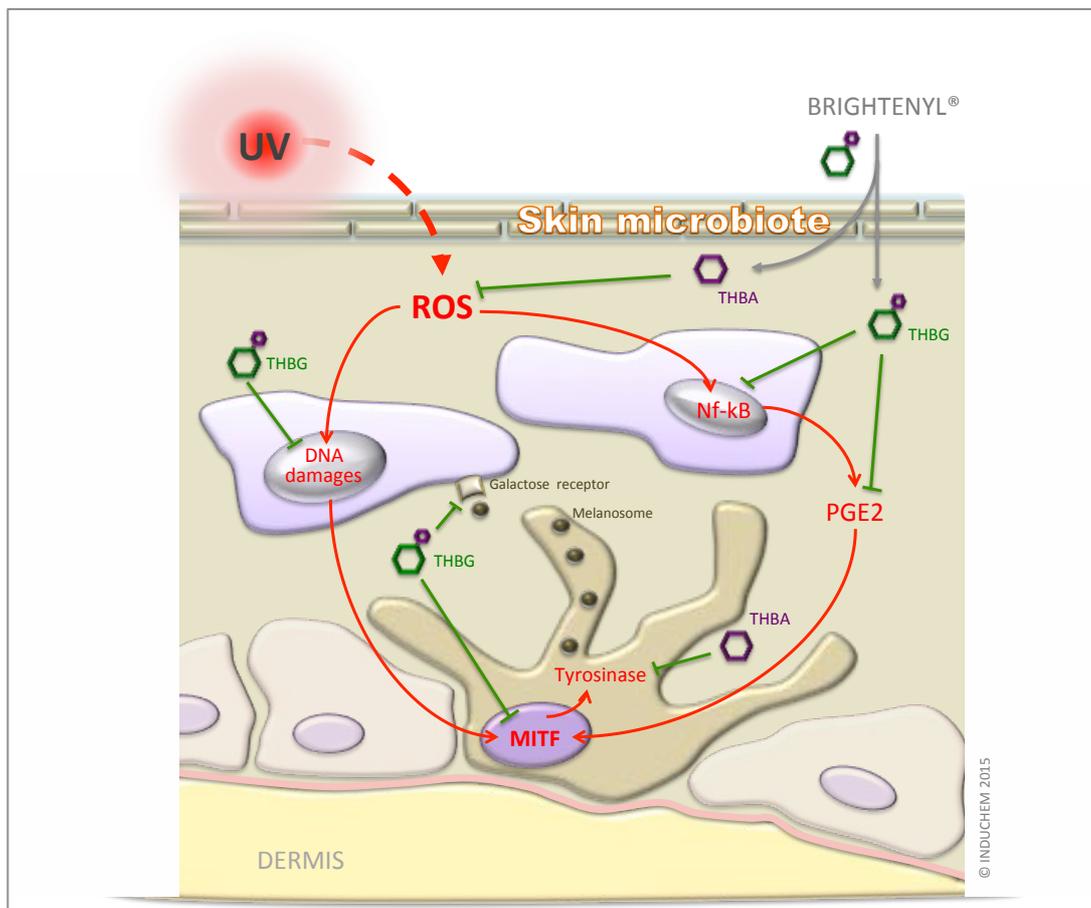
Raman spectroscopy and *in vitro* tests on human skin microbiote have shown that once applied on skin, THBG is partially converted into THBA by the enzymatic activity of the microbium stratum layer. This process mimics the concept of pharmaceutical pro-drug, which is activated in the human body to become fully functional.

Delivered *in situ*, THBA and THBG act in synergy on 7 biological targets to regulate and optimize the skin complexion:

1. It captures UV induced free radicals (ROS)
2. It prevents UV-induced DNA damages
3. It reduces the expression of PGE2
4. It controls the Nf-kB pathway
5. It controls the expression of MITF
6. It saturates keratinocytes receptors for melanosomes
7. It blocks melanin synthesis even under UV conditions

<sup>2</sup> Gao et al., 2007, PNAS

<sup>3</sup> 40 billions DNA bases reading = reading 160,000 books of 250 pages each, or reading twice the whole Wikipedia EN content (9 millions articles)



Brightenyl® mode of action

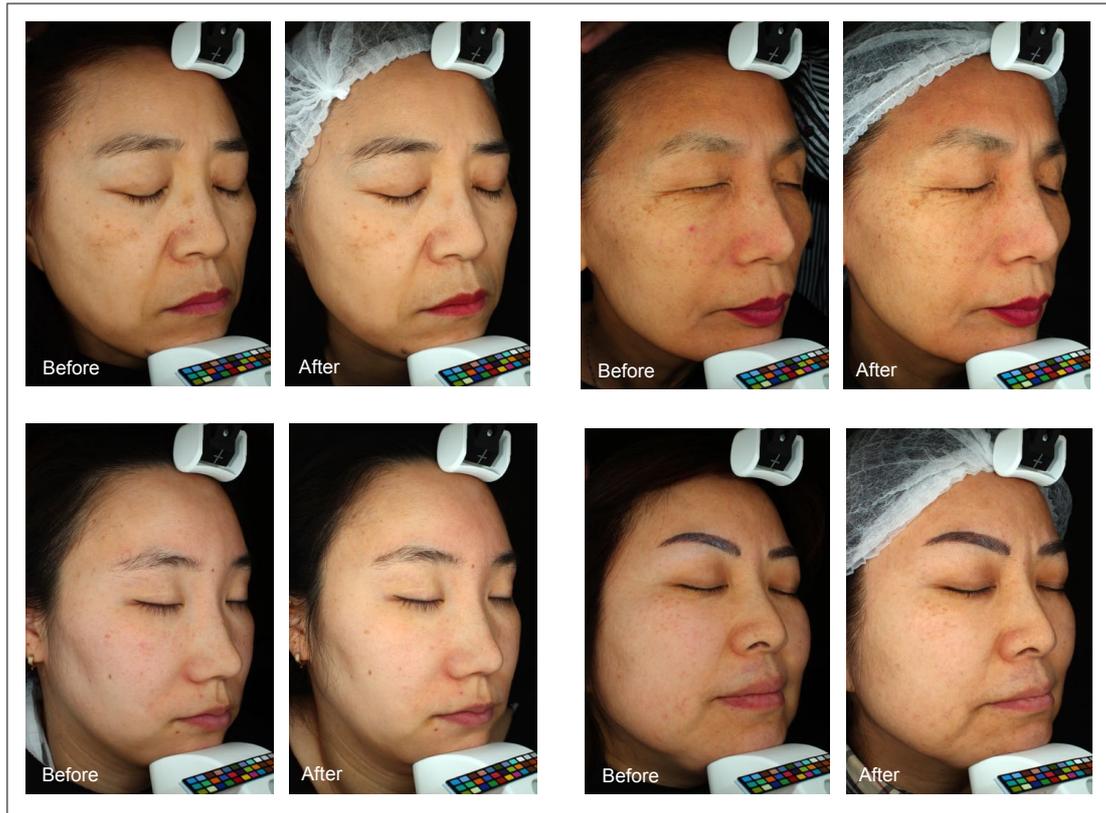
### Outstanding results on skin color and skin tone uniformity

The biological activity of Brightenyl® has been evaluated on a panel of Korean women versus a placebo for a period of 84 days using 3 independent methodologies:

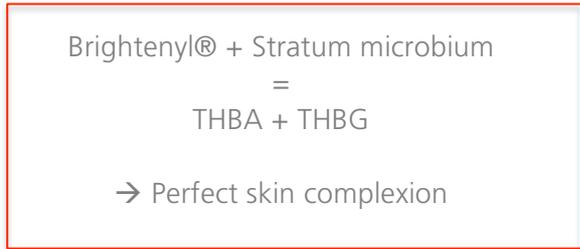
- Full face analysis with the Visia CR,
- Skin color measurement with a Chromameter, and
- Skin melanin content measure at specific sites with the Sciascope.

The volunteers have experienced a clear and visible evolution of the quality of their complexion in 28 days, with long-term benefits after 84 days:

- 18 times decrease of the UV spots on their face
- -150% decrease of the melanin content of their hyperpigmented spots
- -600% decrease of the redness of their skin
- 16 times increase of the brightness of their skin



74% of the volunteers were satisfied by the results (brighter skin, less redness, less hyperpigmentation disorders) and wanted to buy the prototype cream containing Brightenyl®.



### Benefits of using Brightenyl®

Skin tone uniformity and skin color optimization (including reduction of pigmented spots) is among the highest consumers' demands worldwide. Up to now, the only solutions to optimize skin complexion required several ingredients to deliver clinical benefits. Brightenyl® is a **S.M.A.R.T. (Skin-Melanin-Active-Removal-Technology)** ingredient. Far from probiotics, prebiotics and other traditional skin microflora ingredients, it represents a new generation of multifunctional skin complexion

optimizing molecule, which is activated *in situ* by the living veil called the stratum microbium.

Brightenyl® has been created according to the pharmaceutical development processes: an active core (THBA) has been optimized by biotechnology process to generate a stabilized and bioactivable compound through rational design. This compound has been synthesized with cutting edge manufacturing processes, and further evaluated through complete *in vitro* and *ex vivo* tests to understand its multiple modes of action. It has then been tested on human skin in double blind versus placebo conditions under the control of a dermatologist.

By targeting several biological pathways, Brightenyl® addresses all the different causes of uneven skin tone, redness and pigmentation issues simultaneously.

Perfectly safe, it enables creation of new generation of products to enhance consumers' beauty, and meet their expectations.

## Last but not least: S.M.A.R.T. and GREEN



The synthesis of THBG relies on a pure enzymatic process that complies with the 12 rules of green chemistry. This process has been optimized to utilize water only as a solvent and limit the over-usage of energy to manufacture a pure stereospecific molecule in one step. The wastes of the synthesis are mainly composed of water and a small fraction of unreacted THBA. THBG is purified on a column to deliver a >95% pure molecule at the end of the manufacturing process.

## Applications and technical information

Brightenyl® has a light yellow color that does not impact the color of the finished formula. Preservative free, odorless, water soluble and perfectly stable, Brightenyl® is compatible with all kind of cosmetic formulas containing water.

Brightenyl® allows the cosmetic industry to create a new generations of "perfect skin tone and color" products, such as smooth whitening creams, intelligent brightening serums, lightening lotions or sprays, CC creams (color correction creams), skin tone enhancing gels, or anti-pigmented spots serums.

## For more information on Brightenyl®

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### DISCLAIMER

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