PHORMISKIN BIOPROTECH G

THE FIRST BLUE EXOSOMES DEVELOPPED FOR THE COSMETIC INDUSTRY



CODIF
Technologie naturelle

Before starting…
What you should know about Exosomes!



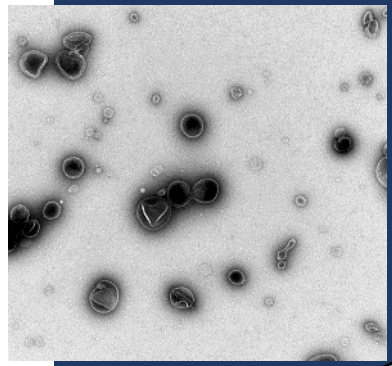


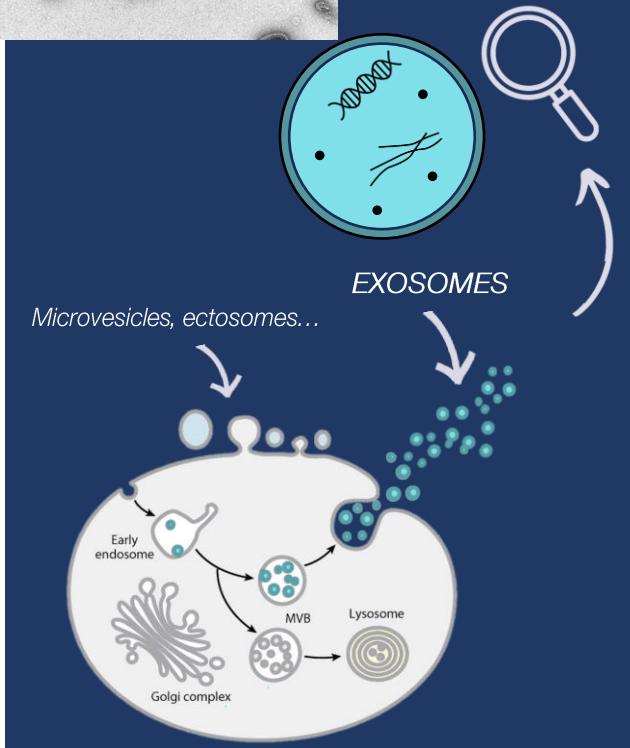
EXOSOMES ARE EXTRA-CELLULAR VESICLES CHARACTERIZED BY:

- SMALL SIZE: ranging from 20 to 150 nm
- A LIPID BILAYER & A CUP SHAPE
- A COMPLEX COMPOSITION: their content, which varies depending on their origin, is extremely rich: thousands of identified proteins, RNA, and lipids have been identified. Their complex cargo can reflect the state of the originating cells and influence the functions of other cells.

ORIGIN & TARGETS OF EXOSOMES

- Present in both eukaryotes and prokaryotes
- Released by cells to facilitate intercellular and interspecies communication.
- Act through membrane fusion, endocytosis, or receptor activation.





https://www.isev.org/misev2023

Tang, P., Song, F., Chen, Y., Gao, C., Ran, X., Li, Y., Chen, Z., Zhang, Z., Wei, W., Peng, Z., Li, Z., & Zhou, C. (2025). Preparation and characterization of extracellular vesicles and their cutting-edge applications in regenerative medicine. Biomaterials Science, 13(5), 102908. https://doi.org/10.1016/j.biomat.2025.102908

Moghassemi, S., Dadashzadeh, A., Sousa, M. J., Vlieghe, H., Yang, J., León-Félix, C. M., & Amorim, C. A. (2025). Extracellular vesicles in nanomedicine and regenerative medicine: A review over the last decade. Journal of Controlled Release, 256(7), 789-801. https://doi.org/10.1016/j.jconrel.2025.01.004

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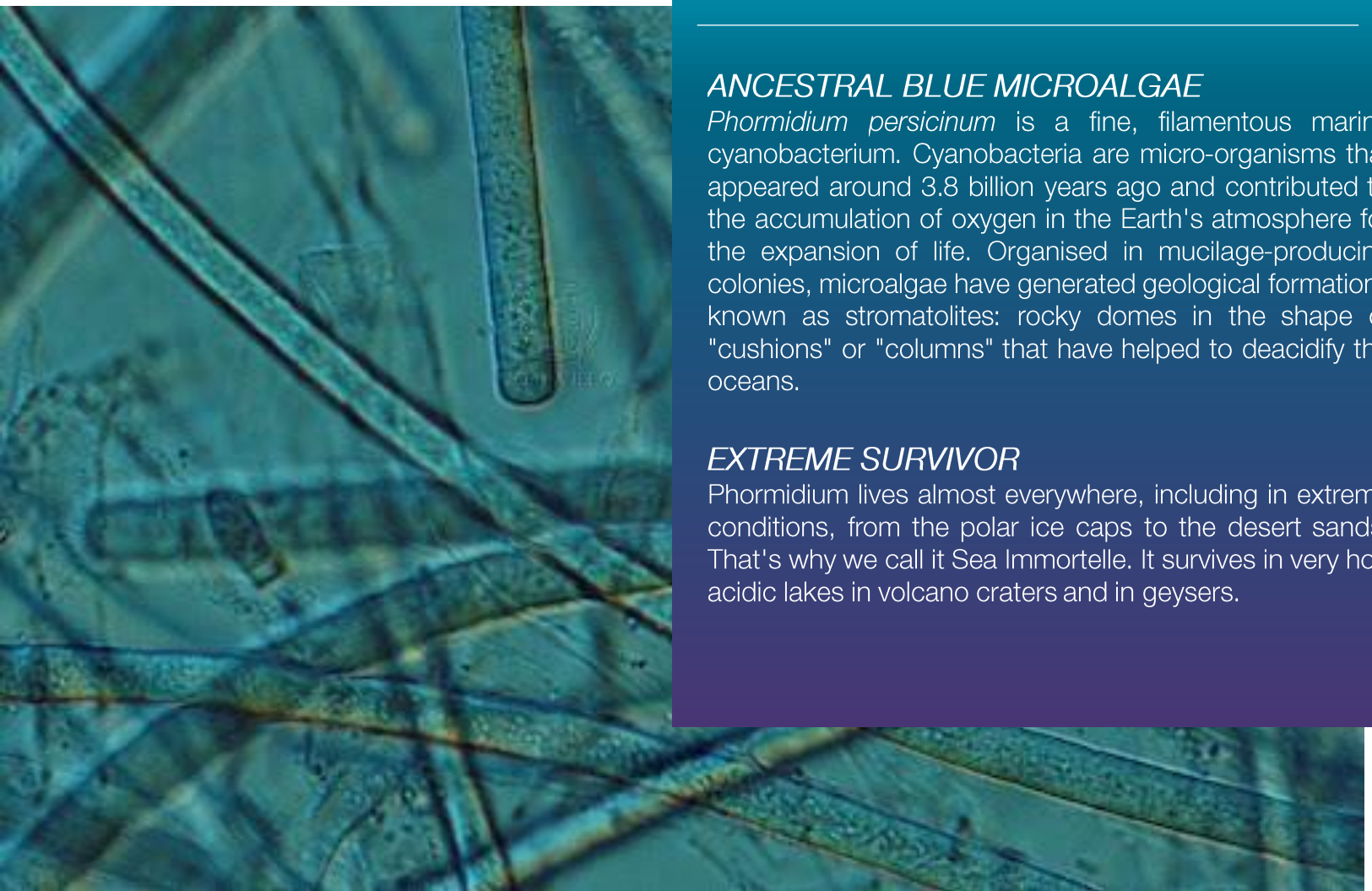
How CODIF TN has discovered Blue Exosomes...



THE STARTING POINT



Stromatolites at Shark Bay, Australia



PHORMIDIUM PERSICINUM

ANCESTRAL BLUE MICROALGAE

Phormidium persicinum is a fine, filamentous marine cyanobacterium. Cyanobacteria are micro-organisms that appeared around 3.8 billion years ago and contributed to the accumulation of oxygen in the Earth's atmosphere for the expansion of life. Organised in mucilage-producing colonies, microalgae have generated geological formations known as stromatolites: rocky domes in the shape of "cushions" or "columns" that have helped to deacidify the oceans.

EXTREME SURVIVOR

Phormidium lives almost everywhere, including in extreme conditions, from the polar ice caps to the desert sands. That's why we call it Sea Immortelle. It survives in very hot, acidic lakes in volcano craters and in geysers.



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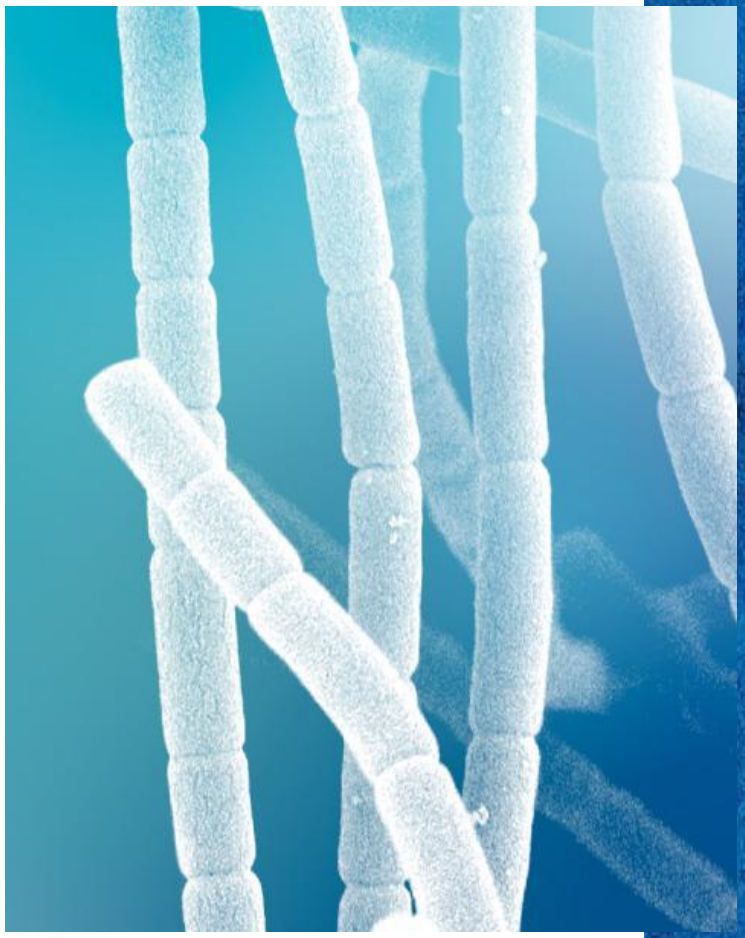
WHAT IS REMARKABLE IN PHORMIDIUM PERSICINUM

A SUPER POWERFUL ANTIOXYDANT SYSTEM: THIOREDOXIN

The ability of Phormidium persicinum to withstand high doses of UV is due to its ability to synthesize Thioredoxin. Thioredoxin is a universal and ancestral 12 kDa protein. It is one of the main components of the thiol reduction system, giving it powerful antioxidant properties. Thioredoxin captures and neutralizes free radicals while reactivating the cellular repair system.

A PARTICULAR ORGANISATION REQUIRING EFFICIENT INTERCELLULAR COMMUNICATION: EXOSOME?

This blue unicellular microalgae joins with its congeners to form filamentous structures. This ability to come together to form a specific and characteristic structure involves a communication system that could be exosomes.



(1) The ecology of cyanobacteria: Their diversity in time and space. B.A. Whitton,M. Potts

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PHORMISKIN BIOPROTECH

Sourcing & Tech

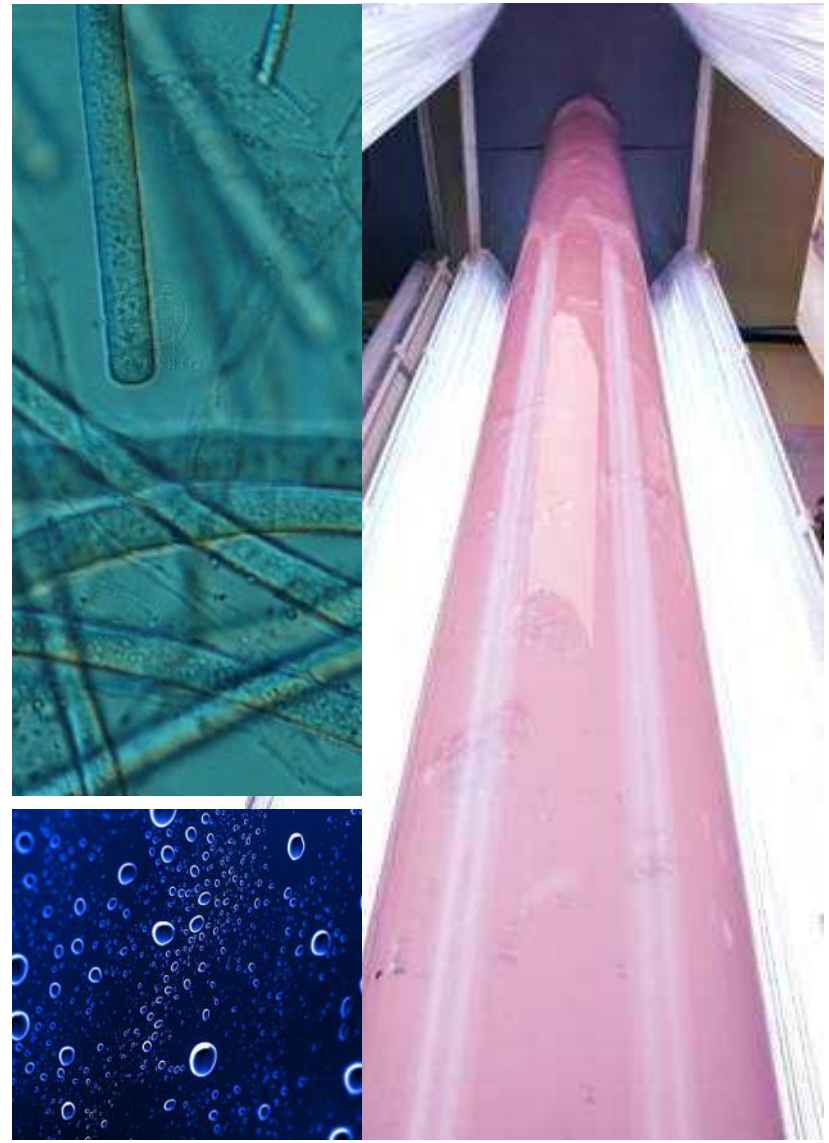
BIOTECH SOURÇING

Codif TN was the first to develop cutting-edge biotechnological tools to cultivate *Phormidium persicinum* in photobioreactors. The resulting extract is water-soluble, completely natural, rich in valuable molecules, and environmentally friendly.

RESEARCH AND IDENTIFICATION OF EXOSOMES

- Use of NTA (Nanoparticle Tracking Analysis) to analyse the size of Extracellular Vesicles: less than 150nm
- Use of TEM (Transmission Electron Microscopy) to analyse the shape: cup shape
- Use of Ultracentrifugation + Proteomic to analyse the content: proteins, RNA, enzymes…
- Use of labelling of membranous protein which is specific to prokariote exosomes to quantify: several millions Exosomes per ml.

CODIF TN has identified, described and quantified Exosomes from Blue Micro-Algae.
We call them BLUE EXOSOMES.
Phormiskin Bioprotech contains several millions Blue Exosomes per ml.



*The information provided is for guidance only and does not constitute a guarantee of the origin of our supply. In accordance with our UEBT commitment, we mostly practice dual fair sourcing; however, other sources may coexist.
For more details about our sourcing, please refer to the corresponding technical and regulatory document, available upon request.

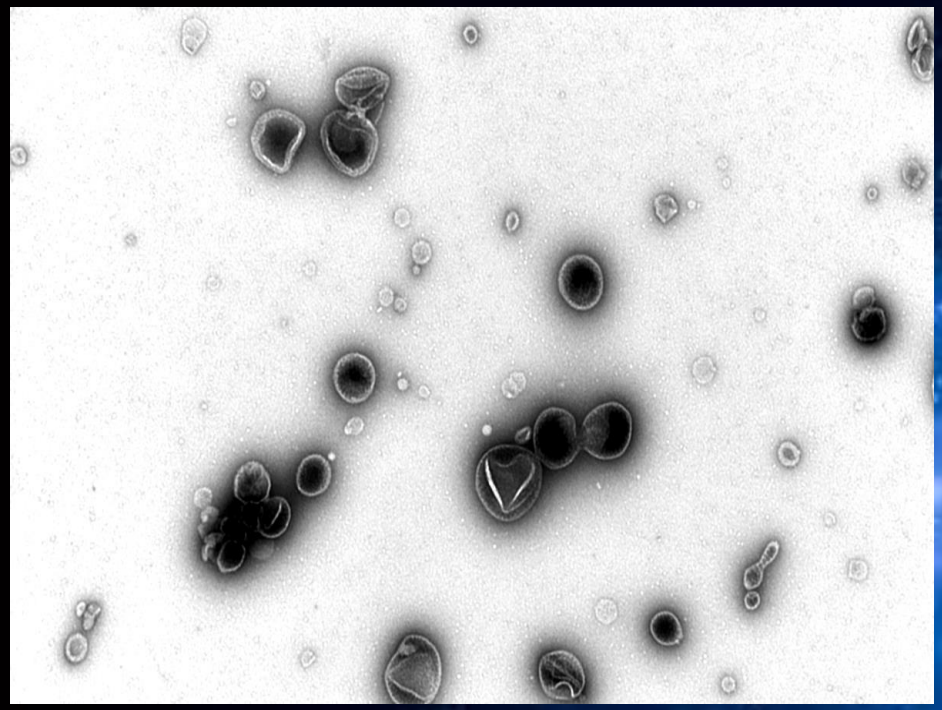
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BLUE EXOSOMES

Identification and Quantification

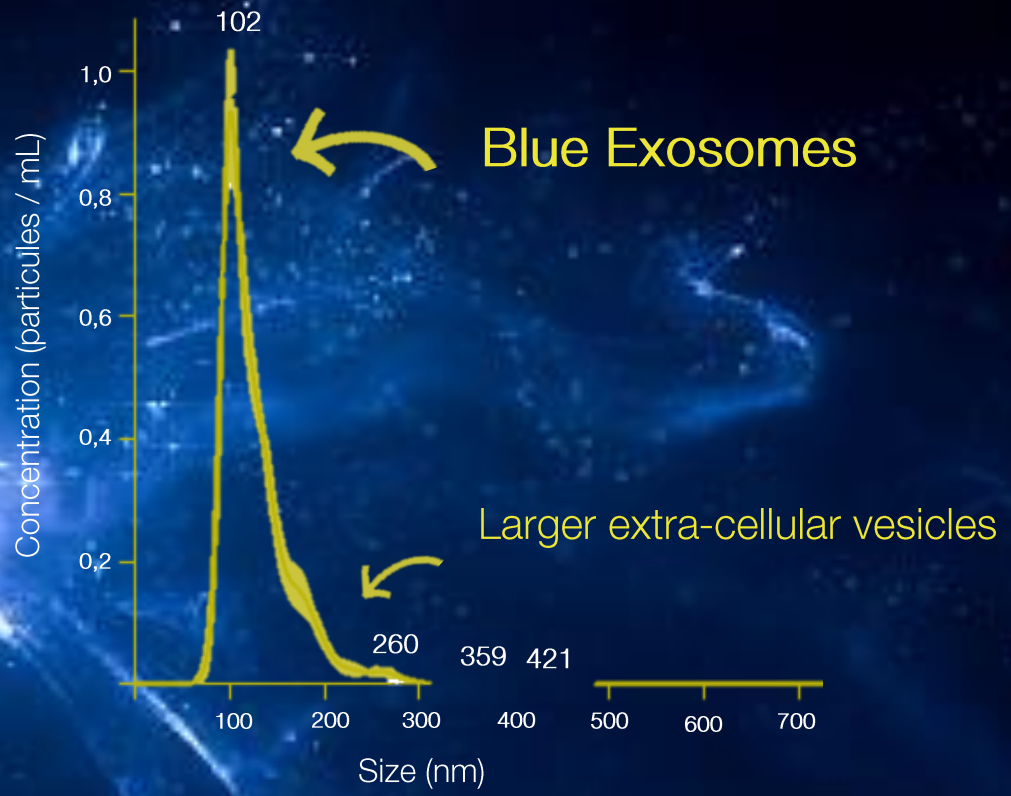
MILLIONS OF BLUE EXOSOMES

Per mL of active ingredient



Visualization of Exosomes and their specific cup shape using TEM method

Identification of Blue Exosomes
in Phormiskin Bioprotech using the NTA method



BLUE EXOSOMES

The super power of *Phormidium persicinum:* THIOREDOXIN is transmitted to the skin through Blue Exosomes.

BLUE EXOSOMES, AN EXCLUSIVE SIGNATURE

The Blue Exosomes of *Phormidium persicinum* are particularly interesting due to their richness in proteins, with

780 proteins identified within exosomes.

Among these, 30% are membrane proteins and 70% are cytosolic proteins. They also contain proteins with antioxidant properties, such as Thioredoxin and glutathione-dependent peroxiredoxin. Furthermore, these exosomes contain RNA, a characteristic feature of exosomes.

These Blue Exosomes are very specific, as they originate from an ancestral blue microalga, which gives them an exclusive structure and content, rich in bioactive biomolecules, such as RNA and exosomal Thioredoxin.



PROTOCOL

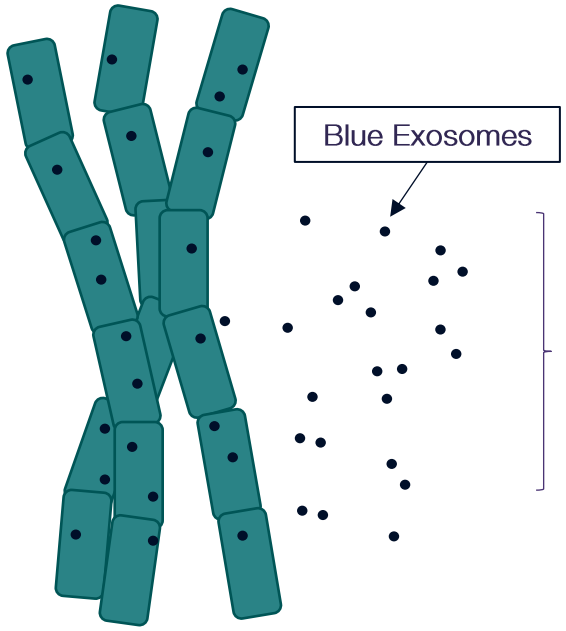
Proteome of purified exosomes from Phormiskin Bioprotech obtained by mass spectrometry.

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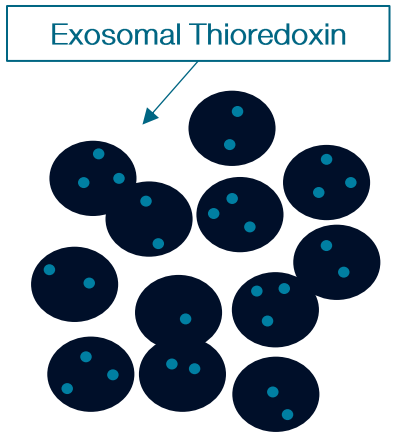
BLUE EXOSOMES

The super power of *Phormidium persicinum* transmitted to the skin through Blue Exosomes

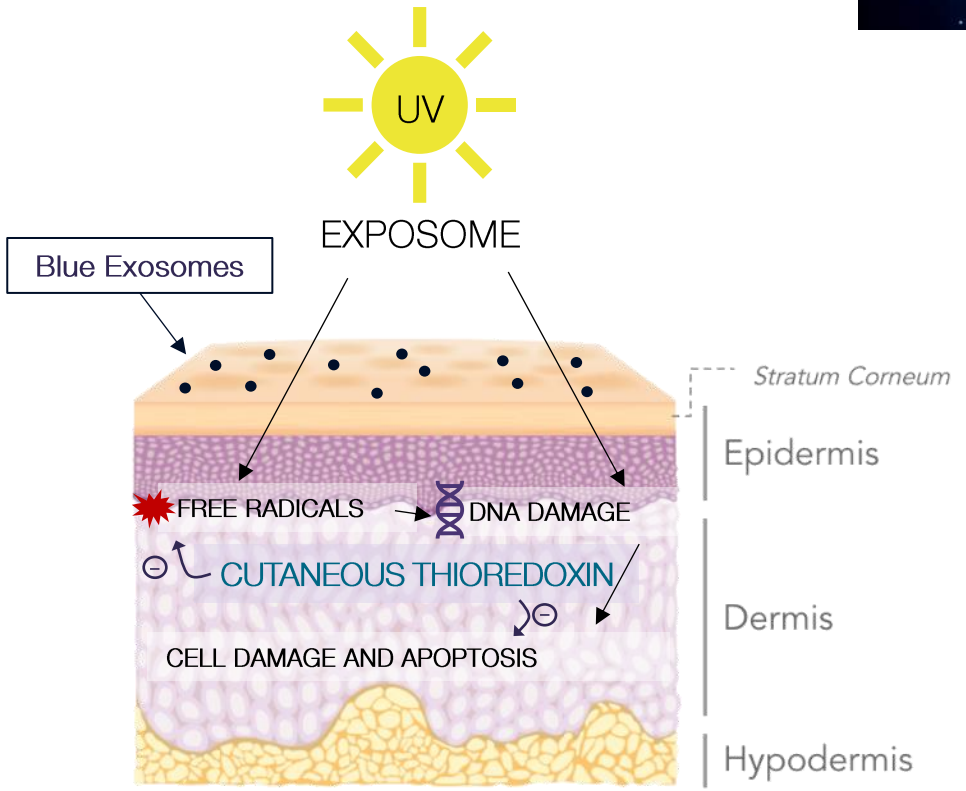
CONTEXT



Phormidium Persicinum



Blue Exosomes of Phormidium Persicinum



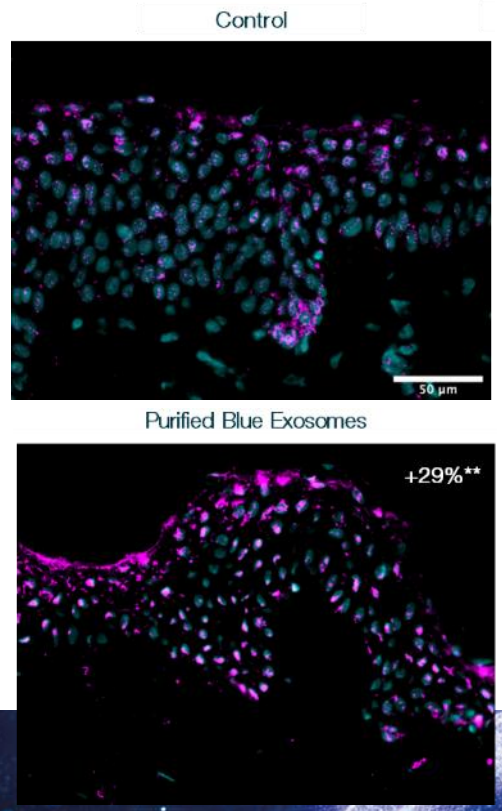
Global skin Photo ageing

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Blue Exosomes deliver the super power of Phormidium to the skin

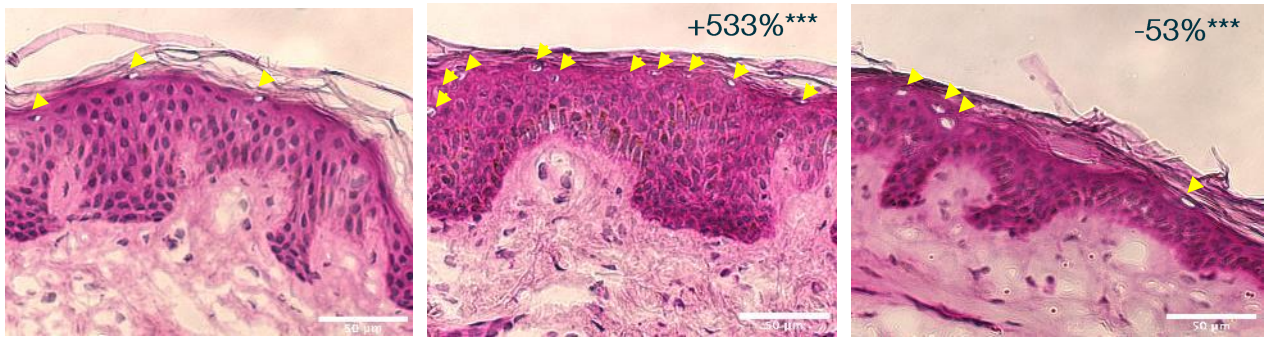
EX-VIVO TEST

1 BLUE EXOSOMES STIMULATE THIOREDOXIN SYNTHESIS IN HUMAN SKIN: +29%**



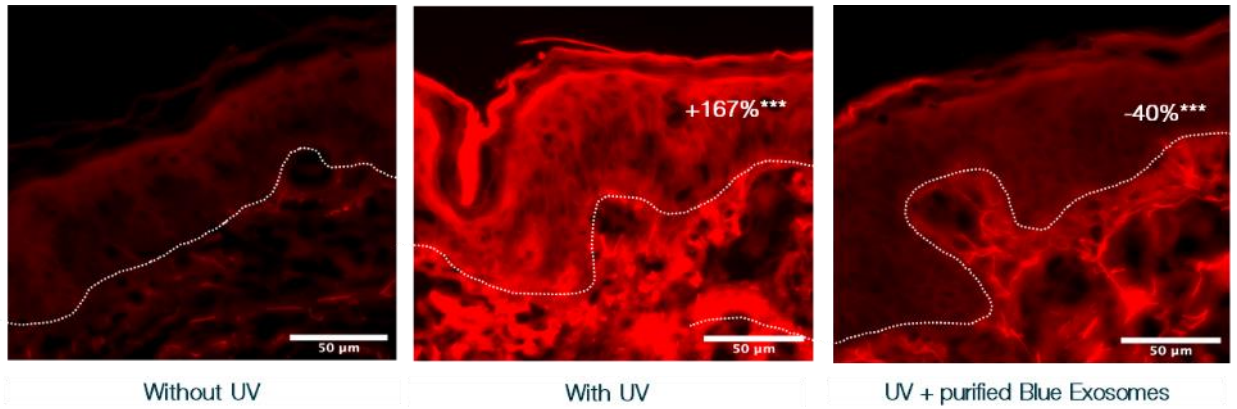
2 BLUE EXOSOMES PROTECT DNA FROM UV DAMAGES: -53%***damages

Visualization of Pycnotic cells (characterized by an extreme condensation of their nucleus, accompanied by the degradation of their DNA.)



3 BLUE EXOSOMES PROTECT PROTEINS FROM UV DAMAGES: -40%***damages

Visualization of carbonylated proteins in red fluorescence



PROTOCOL

35-year-old Human skin explants treated for 3 days, 3 times a day, with purified blue exosomes.

THIOREDOXINE ANALYSIS
immunostaining vs. DAPI staining.

PICNOTIC CELLS ANALYSIS
UVA stress (12 J/cm²)
H&E staining.

CARBONYLATION ANALYSIS
UVA stress (6 J/cm²)
fluorescent probe in SDS-PAGE. Scoring by oxyproteome score.

***p<0.01 Student's t test*
****p<0,001 Student's t test*

Blue Exosomes deliver the super power of Phormidium to the skin

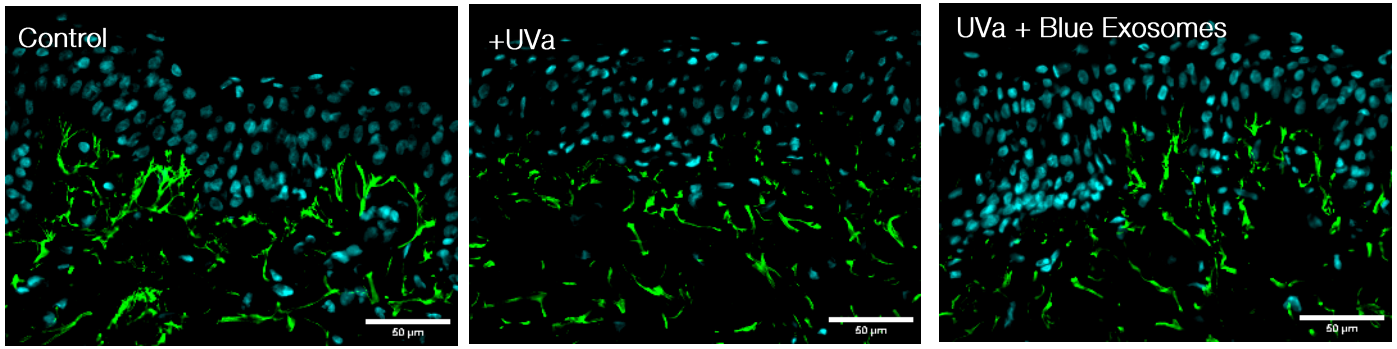
EX-VIVO TEST

PROTOCOL

Explants of 35-year-old human skin treated for 3 days, 3 times a day, with 2% Phormiskin Bioprotech. After stopping treatment for 24 hours, UVA stress (6 J/cm²) was applied.

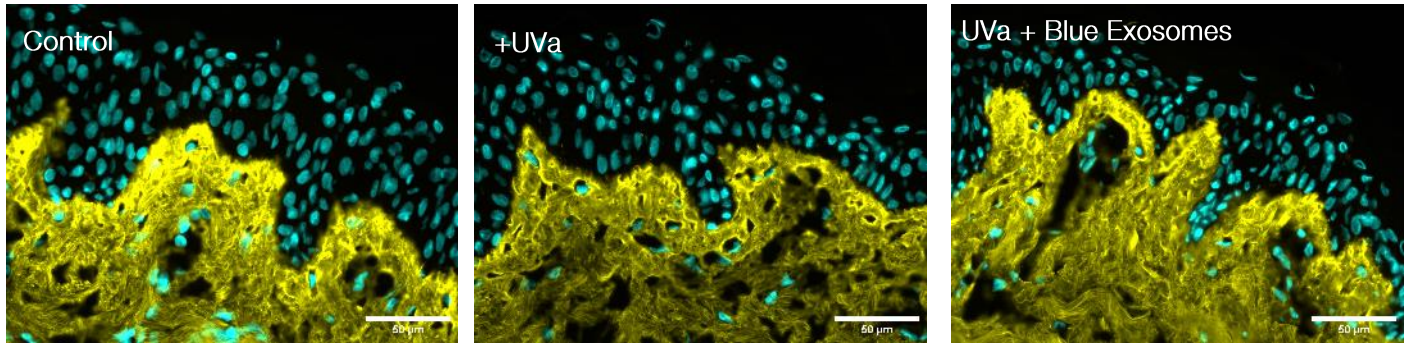
4 BLUE EXOSOMES PROTECT ELASTIN FROM UV DAMAGES: 36%** PROTECTION

Visualization of cell nuclei in blue and elastin fibers in green.



5 BLUE EXOSOMES PROTECT COLLAGEN FROM UV DAMAGES: 59%*** PROTECTION

Visualization of cell nuclei in blue and collagen fibers in yellow-green.



***p<0.01 Student's t test*
****p<0,001 Student's t test*

PHORMISKIN BIOPROTECH

Action Mechanism

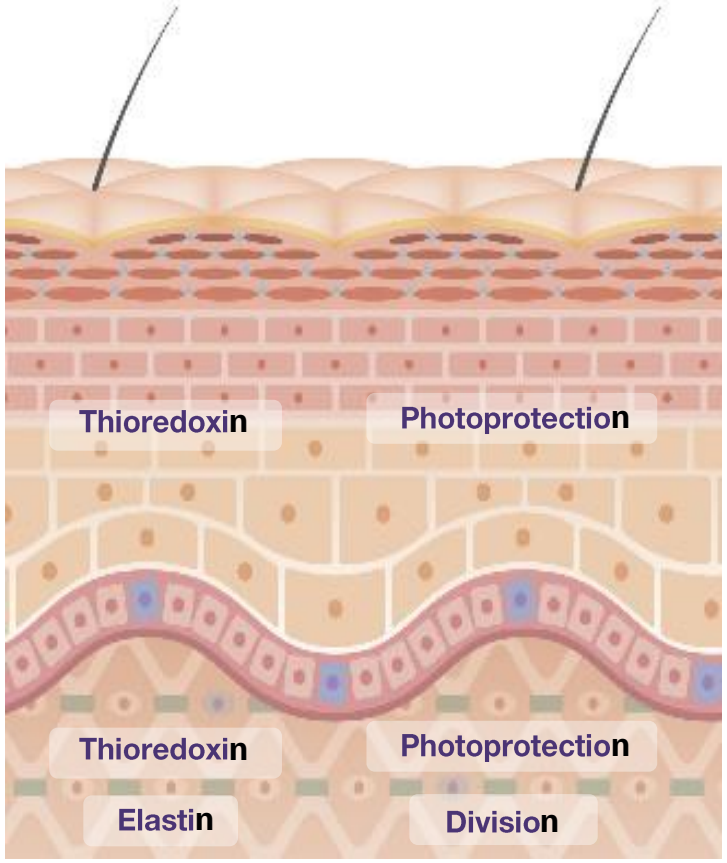
FOCUS ON :

- Photoprotection against DNA damages
- Boosts the protective efficacy of SPF30
- Antioxidant action : Protection against carbonylation
- Anti-ageing effect: Protects and boosts collagen & elastin
- Repairs long-term damages: cell density



PHOTOPROTECTION
COLLAGEN PROTECTION
ELASTIN PROTECTION

ACTION ZONES



Corneal layer

Epidermis

Dermal-epiderma junction

Dermis

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PHORMISKIN BIOPROTECH

The super power of *Phormidium persicinum* transmitted to the skin through Blue Exosomes

IN-VITRO TEST

PROTOCOL

Normal human epidermal keratinocytes Culture for 24 hours.

Normal human dermal fibroblasts Culture for 24 hours.

Treatment with Phormiskin Bioprotech 0.5%. Analysis by Western Blot method.

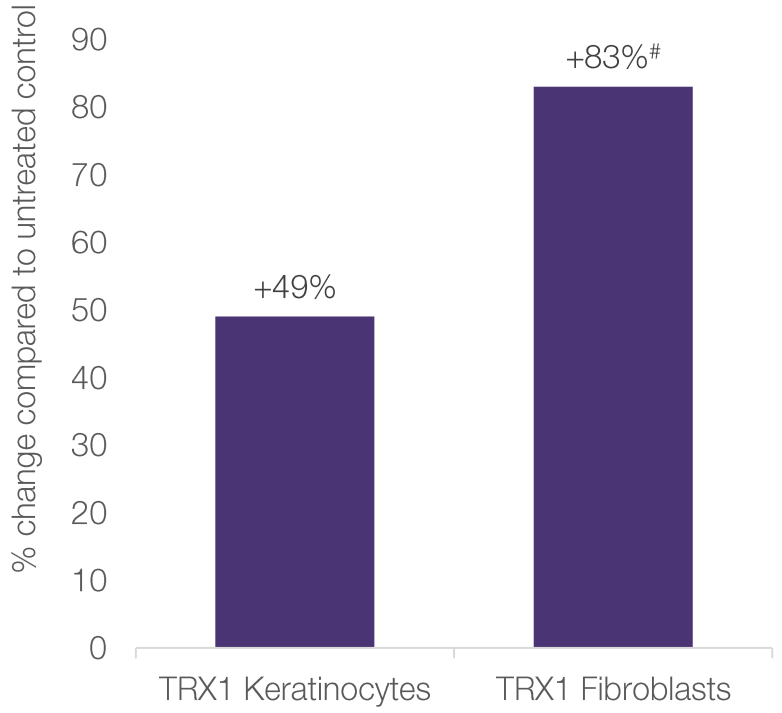
Thanks to its Blue Exosomes, Phormiskin Bioprotech stimulates the synthesis of cutaneous Thioredoxin in fibroblasts and keratinocytes, offering several benefits:

CELLULAR ACTIVITY: Thioredoxin plays several roles in cellular processes such as cell division, differentiation and repair.

PROTECTION: Thioredoxin protects the mitochondrial membrane from oxidation and cells from cytotoxicity caused by free radicals.

Melanogenesis: Thioredoxin also plays an important role in the regeneration of ascorbic acid (vitamin C), a natural inhibitor of melanogenesis.

Effect of Phormiskin Bioprotech on the synthesis of Thioredoxin (TRX1) by skin cells



#p=0.07 Student's t test

CODIF Technologie naturelle

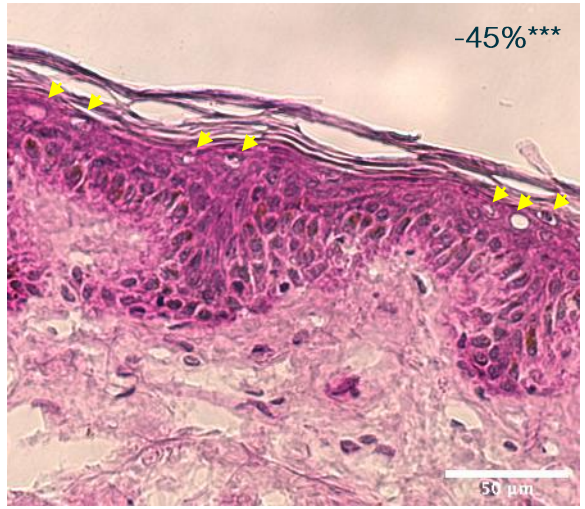
PHORMISKIN BIOPROTECH

Photoprotection: limiting DNA damages

2% EX-VIVO TEST

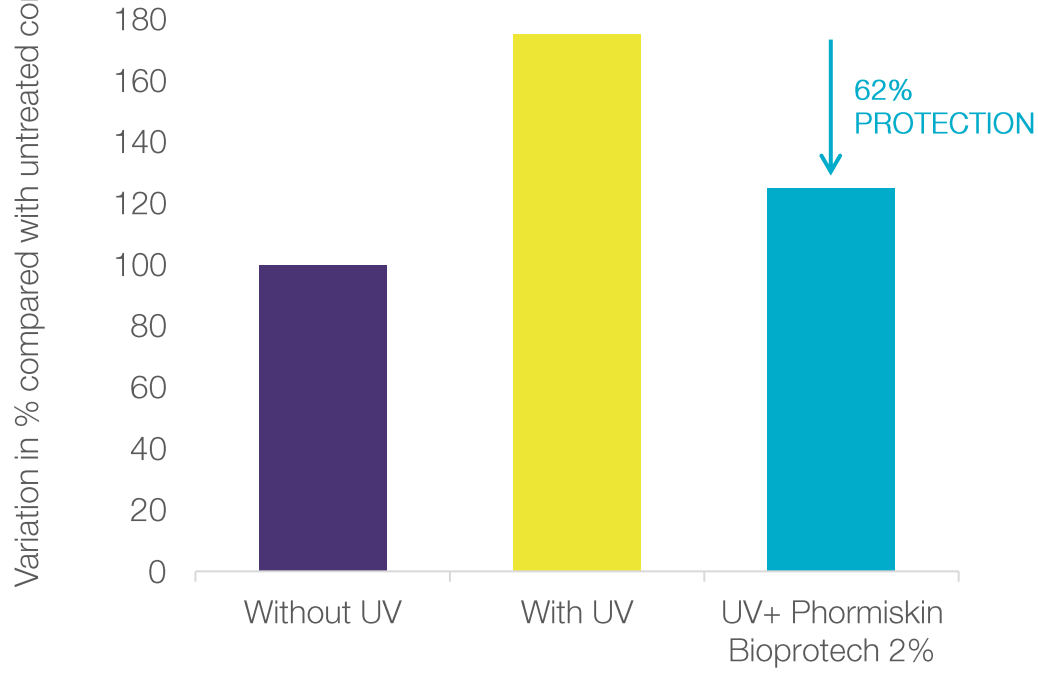
Phormiskin Bioprotech offers 62% photoprotection against DNA damage caused by UV exposure.

In addition, Phormiskin Bioprotech reduces the number of pycnotic cells by -45%***.



UV + Phormiskin Bioprotech 2%

Photoprotective effect of Phormiskin Bioprotech on DNA damages



PROTOCOL

Human skin explants treated for 24 hours with 2% Phormiskin Bioprotech before and after UV stress (50 J/cm² UVA + 500 mJ/cm² UVB). Identification of pyrimidine dimers by immunostaining.

CODIF Technologie naturelle

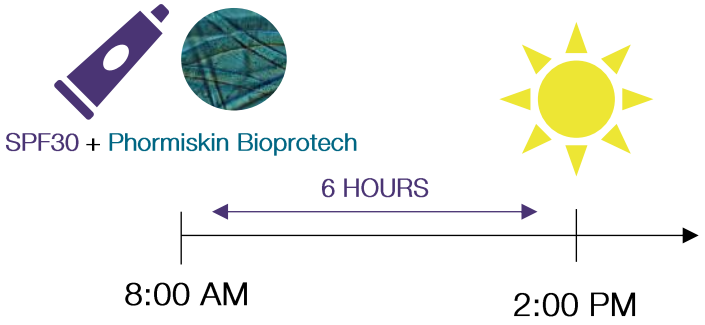
PHORMISKIN BIOPROTECH

Photoprotection: working in synergy with SPF to minimize DNA damages

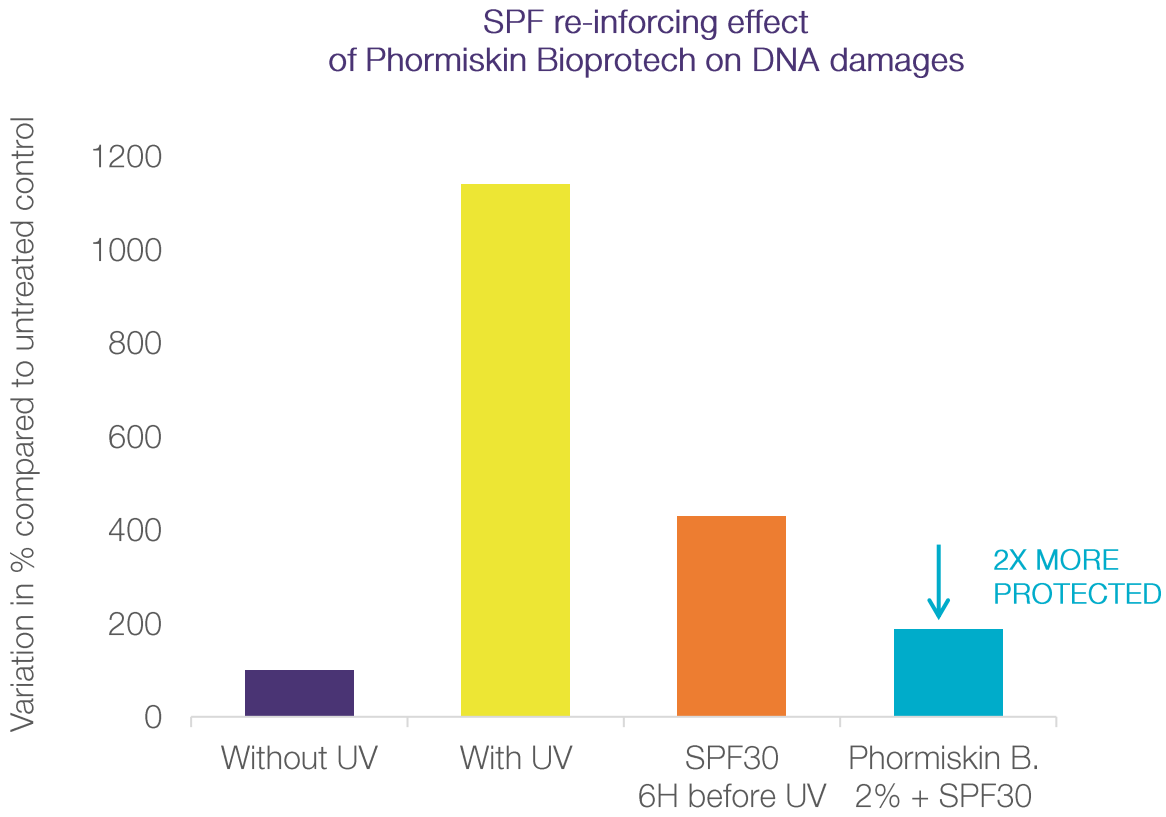
2%
EX-VIVO
TEST

PROTOCOL

Human skin explants treated for 24 hours with 2% Phormiskin Bioprotech and/or SPF30 applied 6 hours before UV stress (50 J/cm² UVA + 500 mJ/cm² UVB). Identification of pyrimidine dimers by immunostaining.



Used in synergy with SPF30, Phormiskin Bioprotech enhances the protective effectiveness of an SPF30 even when applied 6 hours before UV exposure.



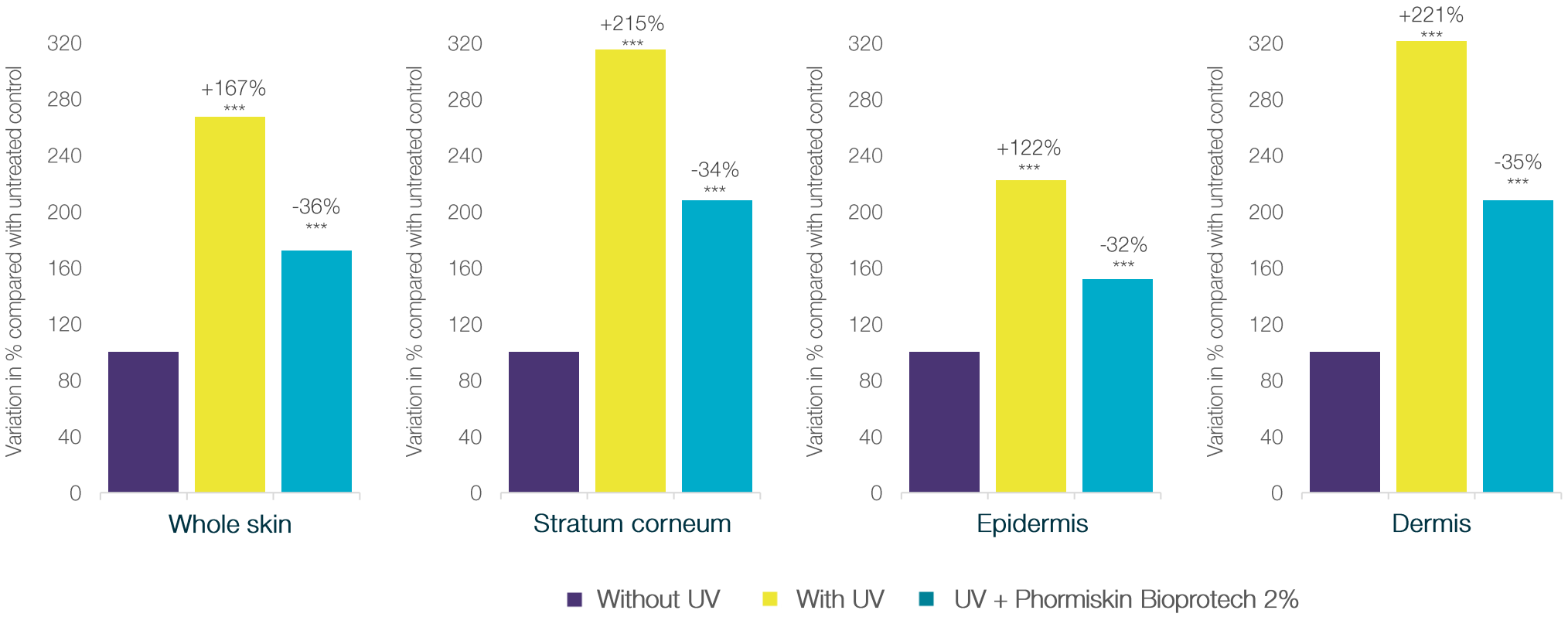
CODIF
Technologie naturelle

PHORMISKIN BIOPROTECH

Photoprotection: protection against carbonylation

2% EX-VIVO TEST

Photoprotective effect of Phormiskin Bioprotech against carbonylation



PROTOCOL

Explants of 35-year-old human skin treated for 3 days, 3 times a day, with 2% Phormiskin Bioprotech. After stopping treatment for 24 hours, UVA stress (6 J/cm²) was applied. Analysis of proteins by the Bradford method, and of carbonylated proteins by fluorescent probe in SDS-PAGE. Scoring by oxyproteoma score.

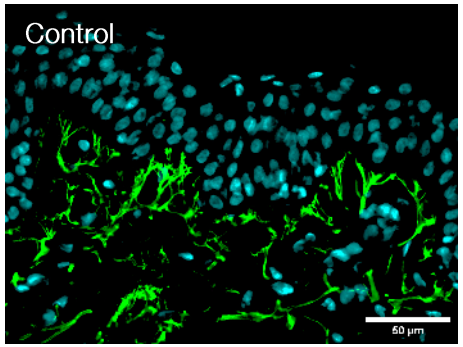
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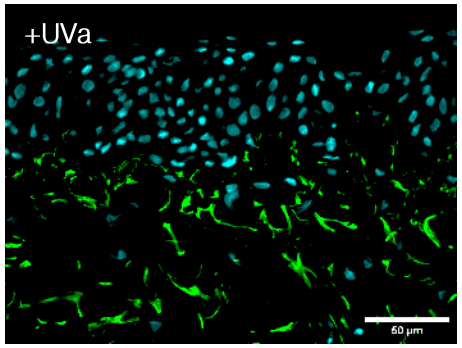
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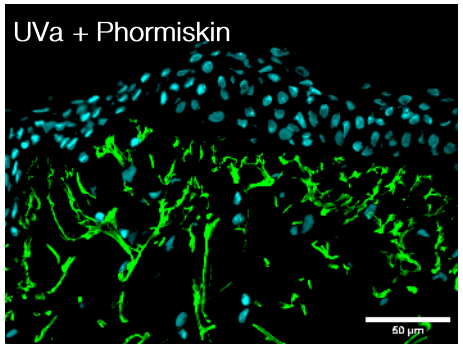
PHORMISKIN BIOPROTECH

Anti-ageing effect: protects Elastin fibres from UV damages

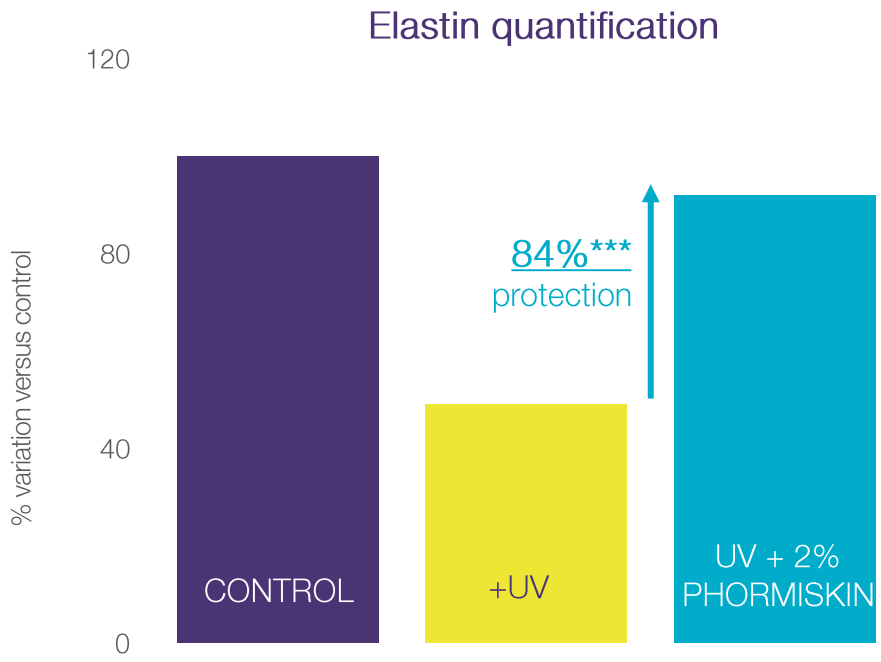
Thanks to Thioredoxin, Phormiskin Bioprotech protects the skin from oxidative damages induced by UV rays, thus limiting cellular stress, protein carbonylation and elastin fibre degradation.







Visualisation of cell nuclei in blue and elastin fibres in green.





PROTOCOL

Explants of 35-year-old human skin treated for 3 days, 3 times a day, with 2% Phormiskin Bioprotech. After stopping treatment for 24 hours, UVA stress (6 J/cm²) was applied.

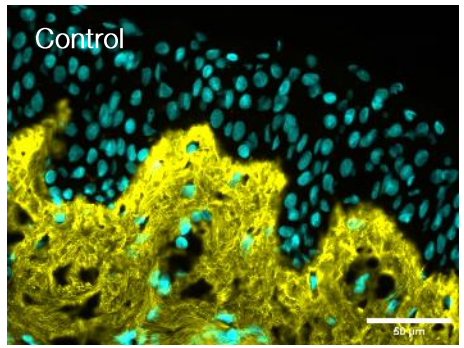
***p<0,01 ; ***p<0,001 Test de Student*

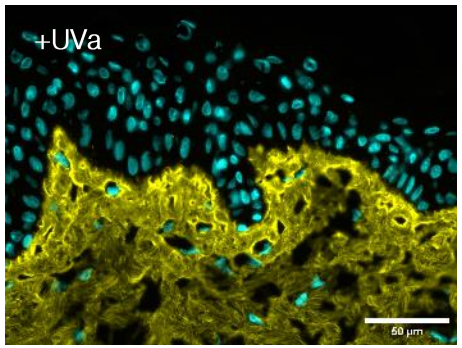
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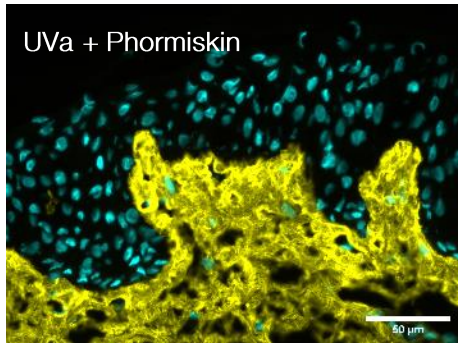
PHORMISKIN BIOPROTECH

Anti-Aging Effect: protects and boosts collagen synthesis

Thanks to Thioredoxin, Phormiskin Bioprotech protects the skin from oxidative damages induced by UV rays, thus limiting cellular stress, protein carbonylation and collagen fibre degradation.





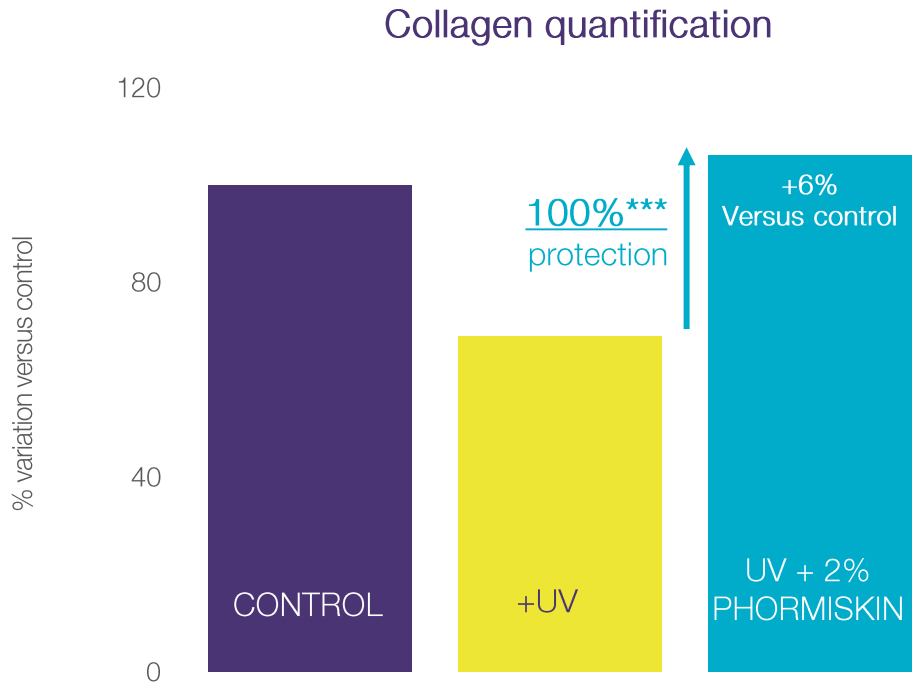


Visualisation of cell nuclei in blue and collagen fibres in yellow-green.



PROTOCOL

Explants of 35-year-old human skin treated for 3 days, 3 times a day, with 2% Phormiskin Bioprotech. After stopping treatment for 24 hours, UVA stress (6 J/cm²) was applied.



***p<0,01 ; ***p<0,001 Test de Student*

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PHORMISKIN BIOPROTECH

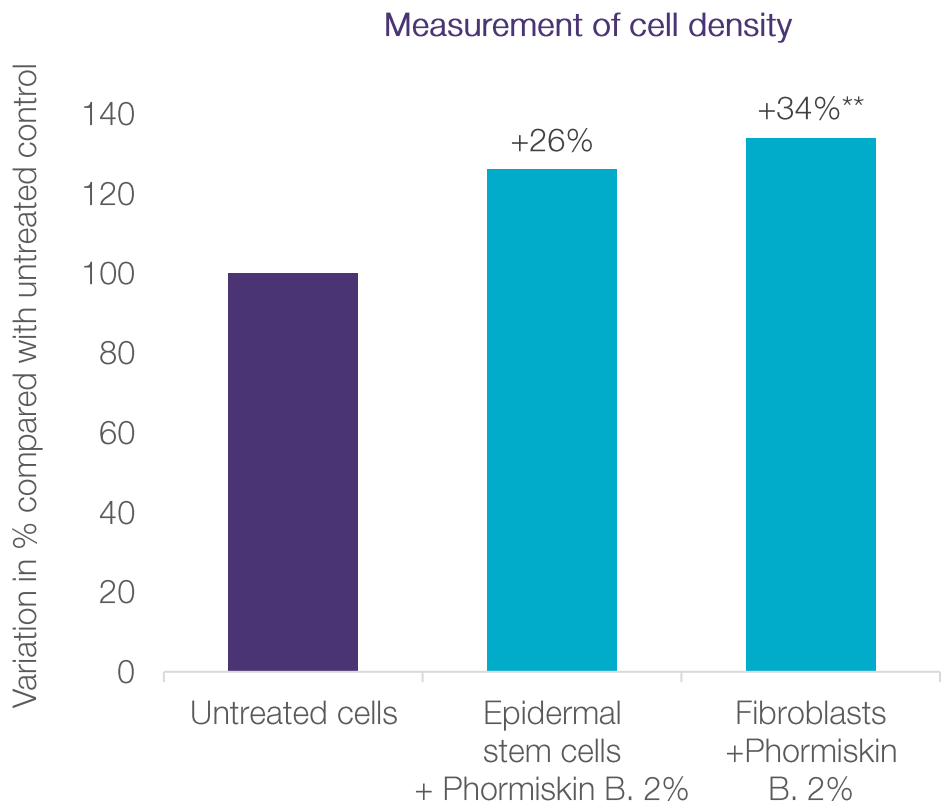
Long-term damage: reactivation of cell division to increase skin density

2%
IN-VITRO
TEST

Over time, sun exposure has a destructive effect on the skin, slowing down cell division.

Thanks to the stimulation of Thioredoxin synthesis and its protective effect, Phormiskin Bioprotech promotes cell division, supporting an increase in epidermal and dermal cell density over the long term.

Phormiskin Bioprotech increases the cell density of epidermal stem cells by +26% and fibroblasts by +34%**.



PROTOCOL

Human epidermal stem cells cultured in a defined medium (without FBS). The medium was changed each time (OD, D3, D7 and D10). Addition of 2% Phormiskin Bioprotech at D0, D3 and D7. Cell vitality was assessed on day 10 using the WST1 method.

Human fibroblasts cultured with 2% Phormiskin Bioprotech for 48 hours. Analysis of cell density by Hoechst staining.

***p<0.01 Student's t test*

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PHORMISKIN BIOPROTECH

Photoprotection of the skin

IN-VIVO STUDY
Expected results for summer 2025



PHORMISKIN BIOPROTECH

Scientific communications

PERSONAL CARE 2010
Sustainable marine actives from biotechnology. *CODIF International*

PERSONAL CARE 2010
New solution for brighter and younger skin. *CODIF International*

COSM'ING – *2007*
In vitro culture of microalgae for developing an extract that stimulate a new system of protection for human skin cells. *CODIF International*

PARFUMS COSMÉTIQUES ACTUALITÉS - 2007
Cosm'ing 2007 : un grand cru. *CODIF International*

IFSCC 2006
Effect of Microalgal Extracts on Thioredoxin Expression in Human Skin Cells and Their Protection of Skin. *CODIF International*



PHORMISKIN BIOPROTECH

The first Blue Exosomes for the cosmetic industry

USE

ORIGIN



Phormidium persicinum
Ancestral blue microalgae

Photobioreactor

BENEFITS

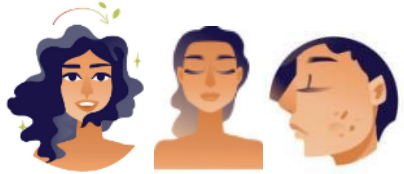


Photoprotection

Skin repair

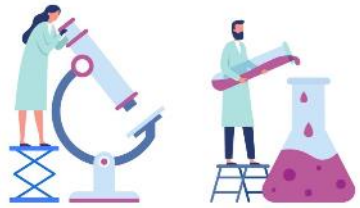
Anti-ageing

TARGETS



Young skins
Mature skins
Photo-damaged skins

FORMULATION



Soluble in water

T°: up to 50°C

pH: 4.5-8.5

% : 2%

INCI

PHORMISKIN BIOPROTECH G

Glycerine (and) Sea water (and) Phormidium Persicinum extract

% OF USE
2%

OK COSMOS

CODIF
Technologie naturelle

PHORMISKIN BIOPROTECH – EXTRA DATA

Inhibition of melanin synthesis

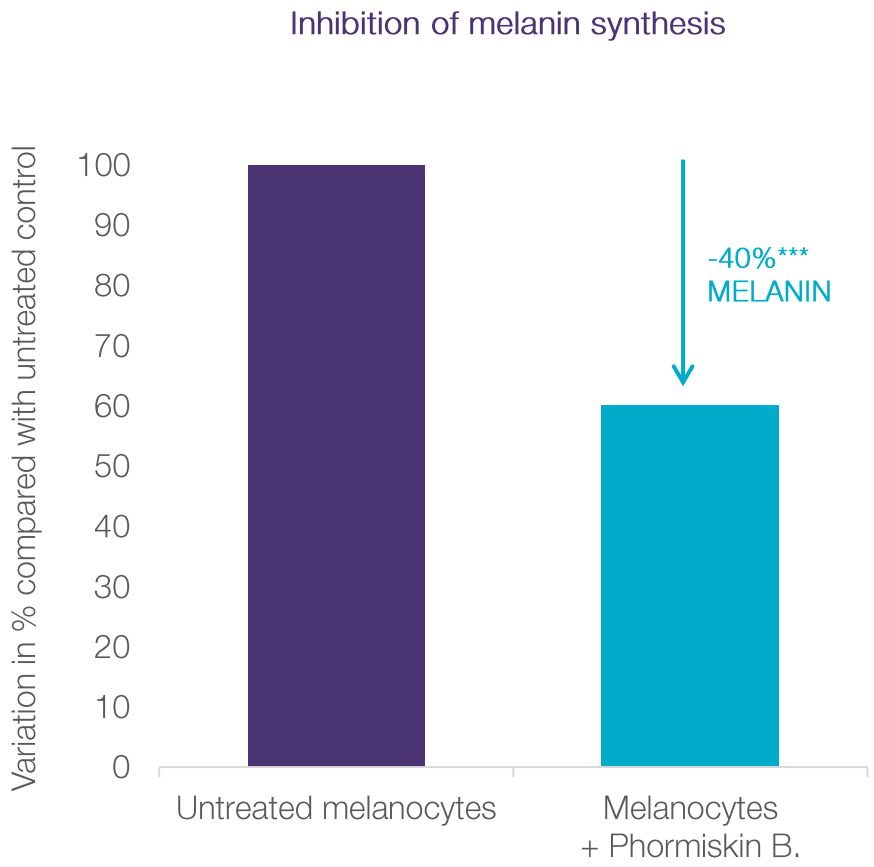
0,5%
IN-VITRO
TEST

PROTOCOL

B16 melanocytes cultured with or without 0.5% Phormiskin Bioprotech for 72 hours.

Cells with damaged DNA, such as pycnotic cells, trigger an inflammatory response in the skin. The inflammatory mediators activated stimulate melanin synthesis.

By stimulating the synthesis of Thioredoxin in the skin, Phormiskin Bioprotech provides overall photoprotection and thus promotes the inhibition of melanogenesis. Thioredoxin also inhibits α-MSH, which is involved in the regulation of melanogenesis.



****p<0.001 Student's.t test*

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PHORMISKIN BIOPROTECH G

THE FIRST BLUE EXOSOMES DEVELOPPED FOR THE COSMETIC INDUSTRY



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