

The next generation of stem cell cosmetics

Ice Age cosmetics with Ice Age survivors



Ice Age cosmetics based on stem cells from extremophile Alpine flowers which survived the Ice Age

photo: Mibelle

PhytoCellTec Nunatak is the first active ingredient that is based on a rare flower that survived the last Ice Age in the Alps. Beata Hurst from Mibelle Biochemistry shows that the extract of *Saponaria pumila* stem cells effectively promotes the activity of dermal stem cells and protects them from UV-induced stress.

The last Ice Age saw much of the northern hemisphere covered in ice. This climatic condition not only represented a threat to mankind and animals, but also to all plant species. During this period, over 90% of all terrestrial life vanished from the northern hemisphere. Only truly robust organisms could quickly adapt and survive the permanently cold and dry climate. Although most alpine plants could not survive, a small number of species escaped the ice by moving to Nunataks – rare ice-free moun-

tain peaks. During the summer months, in particular, there was some water on these ice-free peaks that could be absorbed by plant roots. Alpine Nunataks created strongholds that enabled a small number of plants to survive the Ice Age.

Nunatak plants adapt to Ice Age conditions

Saponaria pumila (Caryophyllaceae) belongs to the Nunatak plant species, which developed special protection and repair mechanisms to

quickly and sustainably adapt to the extreme conditions of the last Ice Age. This extremophile plant, which features pretty pink flowers, can still be found today in the Alps.

The survival characteristic of *Saponaria pumila* is hidden in its stem cells which, thanks to **PhytoCellTec** plant stem cell technology, are now available for skin care. This advanced biotechnology allows cultivation of the stem cells of this distinctive plant. It is a method of sourcing raw material which is considered an eco-break-



photo: Mibelle

The extract of *Saponaria pumila* plant stem cells increases the vitality of dermal stem cells and protects them from UV-induced stress

through in natural cosmetics. This resulted in **PhytoCellTec Nunatak**, the active ingredient based on *Saponaria pumila* stem cells being named runner-

function and is mediated by adult stem cells located in the basal layer of the epidermis. Meanwhile, it has become a global trend in cosmetics to protect or vitalize stem cells in the epidermis. Various in-vitro test systems using epidermal stem cells have been established, allowing claims for epidermal stem cell actives.

Targeting dermal stem cells

What about the stem cells in the dermis? Until now, cosmetic treatments have rarely addressed them despite the fact that they play a decisive role in skin ageing. Fibroblasts – the prominent cell type in the dermis – are responsible for continuously producing collagen and elastin, which form the extracellular matrix and confer elasticity and firmness to the skin. Ageing skin is characterized by an increasing number of senescent fibroblasts. These cells stop producing collagen and elastin and even start to break down the existing matrix. Only dermal stem cells can replace these senescent cells by new fibroblast cells. Stem cells have only recently been identified as helping to generate new fibroblast cells. These cells are now the focus of intense research in regenerative medicine and thus of interest for cosmetic treatments.

It has been shown that the extract of *Saponaria pumila* plant stem cells increases the activity of dermal stem

up at the **Organic Monitor's** international **Sustainable Beauty Awards** in November 2014. These awards recognize organizations that push the boundaries of sustainability in the beauty industry.

The next generation of stem cell cosmetics

Stem cells are unspecialized cells capable of self-renewing throughout the lifespan of the organism. Adult tissues contain multi- or unipotent stem cells, which indicate they can divide into more than one cell type or only one cell type respectively. These adult stem cells are responsible for a continuous supply of new cells that are essential for repair and regeneration. A perfect example of this is the epidermis, which is constantly renewed and repaired throughout life. This process is essential to maintain the normal barrier

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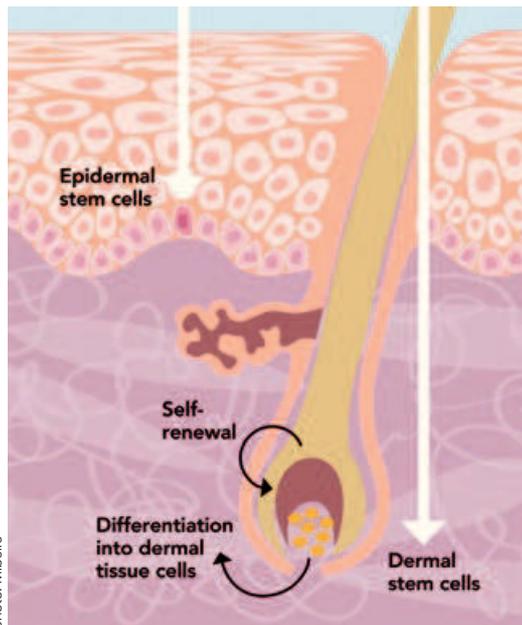


photo: Mibelle

The dermal papilla as a niche of dermal precursor cells

cells and protects them from UV-induced stress.

The dermal papilla is a reservoir of multi stem cells lineages. Dermal papilla cells are predisposed to grow in colonies in spherical form.

However, the number of divisions stem cells in adult tissues can undergo is limited (Hayflick limit) and, as this pool of cells is exhaustible, the life-span of the tissue is limited. Identifying and treating dermal skin stem cells has opened the door to the next generation of stem cell cosmetics: protection and vitalization of human dermal stem cells for true regeneration of the dermal matrix.

Effects after UV/VIS exposure

In an in-vitro system, dermal progenitor cells isolated from the dermal papilla were induced to form spheres in a non-adherent culture using a fully defined CnT-DP-3D medium. To evaluate the protective ability of **PhytoCellTec Nunatak**, dermal papilla cells were cultured in monolayers and exposed to a broad spectrum light source. After exposure, cells were seeded into a non-adherent culture, and sphere formation of the dermal progenitor cells in primary sphere cultures was evaluated.

Treating dermal progenitor cells with this active ingredient showed a positive effect on the sphere number of unexposed cultures (+21%). In UV/VIS

exposed cultures, the sphere number decreased by 48%. This treatment also helped to protect against irradiation, with the sphere number being 35% higher in irradiated cultures compared to the unprotected control. This indicates that the active ingredient enhances the stem cell characteristics formation and proliferation of dermal progenitor cells in cell cultures and protects them, as well as protecting against the harmful effects of UV and visible light irradiation.

Regeneration potential of dermal stem cells

Another study evaluated the size of the spheres that were formed. This provided an important indication regarding the quality of the dermal stem cells. Small spheres (diameter $\leq 50 \mu\text{m}$) regroup cells that have almost lost their capacity to regenerate. Medium spheres ($51 \mu\text{m} \leq$ diameter $\leq 100 \mu\text{m}$) regroup cells with a moderate renewal capacity, while large ones (diameter $\geq 100 \mu\text{m}$) regroup cells with very good regenerative potential.

This test also exposed dermal stem cells to a broad spectrum light source (300 – 800 nm) at $3 \text{ J}/\text{cm}^2$. In the control culture, after irradiation, the largest spheres disappeared and reduced the proliferation capacity of the most vital cells.

Conversely, in cultures pre-treated with *Saponaria pumila* stem cell extract, the repartition of the sphere size was almost entirely unaffected by irradiation as the proportion of large spheres remained at the same level. This demonstrates *Saponaria pumila* stem cells can maintain the renewal potential of the dermal stem cells despite environmental stress.

Re-densifying the skin's matrix

Twenty women aged between 44.2 and 59.5 with sun-damaged skin applied either a cream with 0.4% **PhytoCellTec Nunatak** or the corresponding placebo twice daily for 28 days to the inner side of their forearms. The density of their skin (epidermis and dermis) was determined by ultrasonic measurements.

The ultrasonic wave generated echoes when partially reflected at the boundaries between different tissue structures. The intensity of the reflect-

ed echoes can be evaluated and visualized in a colour image. The collagen and elastic fiber structure of an intact dermis yields many reflections that are visible as bright colours on the ultrasonographic image.

However, disrupting this regular architecture leads to weaker reflections and dark patches, as can be seen in the ultrasonographic images at Day 0. These subepidermal low-echogenic bands are commonly found in aged and photo-damaged skin. Applying the active ingredient over 4 weeks re-densified the dermis by almost 10% compared to initial conditions.

Enhanced dermal stem cell activity

Fibroblast cells are the most prominent cell type in the dermis and are responsible for the continuous production of elastin and collagen. These two important structural components build up the extracellular matrix, giving the skin its properties of elasticity and tensile strength. Fibroblasts have limited life expectancy and, with age, become less active and decrease in number. Consequently, senescent fibroblasts are no longer replaced by new ones and the skin loses its elasticity and firmness due to the drop in elastin and collagen production. The recently discovered human dermal stem cells were found to self-renew and differentiate into dermal cell types like fibroblasts.

Analyzing their stem cell characteristics showed that the extract of *Saponaria pumila* stem cells effectively promotes the activity of dermal stem cells and protects them from UV-induced stress. The first active ingredient that is based on the rare flower that survived the last Ice Age in the Alps is **PhytoCellTec Nunatak**. Ultrasonographic images have shown that these plant stem cells increase the density of the dermal tissue, leading to a reduction of subepidermal low-echogenic bands that are found in aged and photo-damaged skin.

Additional information can be found on the Internet – see Internet panel

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