

# Regeneration - the potentials of cosmetic products

published in Beauty Forum 2003 (3), 72-74

In general usage, the term regeneration already is more or less identified with a magic formula against skin aging. Accordingly, there is a large variety of different prescriptions in form of products and treatments on the market. Quite evidently, the aging process of the skin cannot be stopped; however, prevention may contribute to alleviate its symptoms.

**R**egeneration implies that some kind of damage has occurred before, such as a sun burn for instance, leaving behind symptoms of radiation damage on the skin after the first signs have disappeared. In case of recurrent damage the skin becomes susceptible for premature aging. After the skin is already damaged, the treatment with appropriate cosmetic products to accelerate the skin's regeneration may only help to a certain degree. Far more important is the prevention of any possible damages and in this field, cosmetics can offer an important contribution.

Prevention for instance means applying sun protection products. However, these products will not protect from infrared radiation (heat radiation) which generates a considerable temperature rise in the surface skin layers in case of over-exposure and consequently also accelerates the aging process of the skin. Appropriate clothing or staying in the shade are the only two alternatives.

The skin acts like a bank account. Overdrafts are quite expensive and the savings balance will still be at our disposal even in advanced age. A specific treatment of damages and symptoms of increasing age is very difficult and expectations towards a long-term firming of the skin with collagen or similar products for example have proved to be unrealistic. Of course, limited-period effects may be achieved by injecting collagen or hyaluronic acid products in wrinkles and lines, however, we are dealing here with synthetic modifications of the skin which have nothing to do with regeneration.

To maintain its proper function and to repair the damaged parts, the skin either receives substances from the organism or it produces the substances needed right on the spot which involves complicated and networked transport and synthesis processes. Realizable measures to activate the regeneration from outside are based on understanding and influencing these mechanisms.

A long-term application of creams **rich in linoleic acid or liposomes** which are even more appropriate means of transport, leads to a steady increase of the linoleic acid concentration in the skin. On first sight, this is not a special feature, however, on second sight instead of free linoleic acid, a major part of the active agents can be detected in the barrier layers as a part of ceramide I which contains linoleic acid. Ceramide I definitely is one of the most important protective substances of the skin barrier and prevents the skin from dehydration. A ceramide I deficiency causes severe skin barrier disorders and even neurodermatitis. So, linoleic acid which penetrated into the skin from outside is used for the endogenous synthesis of ceramide I and precisely integrated in those parts of the skin barrier where it actually is needed. The experiment to integrate ceramide I or similar substances in form of creams shows less success.

According to several reports, **vitamin C** stimulates the endogenous collagen synthesis which also is an indirect and intelligent activation of the skin's natural regeneration process. Since then, a steady increase in the supply of vitamin C products has been observed and particularly of products containing high dosages. From the physiological view point, there is no use in applying high dosages as the effects of vitamin C on free radicals prove to be counter-productive, similar to vitamin E, and, in addition to that, the keratolytic effects of ascorbic acid will dominate in this case. Vitamin C suspensions may even remove warts which is a well-known fact today. By contrast, comparatively low concentrations have proved successful, which are encapsulated in liposomes or as palmitic acid ester in nanoparticles and thus actively penetrate into the skin. In vitamin C palmitic acid ester, vitamin C will be released enzymatically after the penetration.

**Intentional irritation** of the skin will also activate repair mechanisms. The treatment with alphahydroxy acids (AHAs) is part of this method whereas the deciding factor here is the interaction of a low pH value and the acid concentration. Neglecting due care while working with AHA acids may lead to caustic burns. Still widely unknown is the fact that a three week's treatment with highly concentrated liposomal products will have similar regenerating effects to the application of AHA acids, however, without any side effects, and moreover, this treatment can be applied on a permanent base.

**Retinoids** are a substance class where all the different representatives have a major influence on cell proliferation and growth. The most prominent substances are beta carotene, vitamin A and vitamin A acid. While vitamin A acid is reserved for dermatological treatments, beta carotene and vitamin A respectively its ester are added to a large number of different cosmetic products for regeneration purposes where, among others, the endogenous transformations of beta carotene into vitamin A and vitamin A into vitamin A acid are made use of. These effects may even be intensified by using nanoparticles as transport vehicles.

A very important viewpoint to consider when selecting cosmetic products is the fact that they should not interfere with the **skin's own regeneration process**. Products with occlusive effects which contain high amounts of long-chain mineral oil products reduce the endogenous regeneration in the long run. If the transepidermal water loss (TEWL) is considerably reduced due to an occlusive surface film, the skin moistness will increase and the skin swells up, a process which leads to a reduced synthesis of barrier substances. On a long-term basis, the skin can get used to this condition. Thus, if the surface film is missing, already after a very short period of time the skin starts to feel dry and this feeling still will be intensified, if high concentrations of emulsifiers which are not matching with the specific physiology of the skin are contained in the products used. This applies e.g. for the so-called ethoxilized alcohols. The ethoxylates stored in the skin will be reactivated by water and in consequence increasingly transport endogenous barrier substances out of the skin during the washing process. As a result, barrier disorders are supported and in connection with it, also dry skin.

### Regenerating the horny layer

A very important prevention issue is the appropriate care of the horny layer which forms the outer layer of the skin with its diameter of

about 0.1 to 1mm. The horny layer has a very characteristic structure comparable with a brickwork consisting of dead corneocytes ("bricks") and intracellular lipid bilayers ("mortar"). The mortar here signifies the barrier layers which prevent the skin from dehydrating and impede the penetration of foreign substances. The barrier layers are affected by emulsifiers and also cleansing substances take their toll. In case of a predisposition to dry skin, a very important precaution though is the selection of mild cleansing products which are low in foaming agents.

Consequently, for a preventive skin care, products are recommended which correspond with the physiology of the skin which means that they are able to appropriately replace the deficient substances and, on the other hand are physically able to support the typical structure of the barrier layers (Derma Membrane Structure). Generally, DMS products are free of preservatives and emulsifiers with their straining effects on the skin and prove very appropriate for the sensitive problem skin.

### Membrane substances

Nature uses phosphatidylcholine (PC) as the most important component of all cell membranes and as a link between the ceramides dominating the horny layer and the ubiquitous (= widely spread) sphingomyelins of the live cells. Sphingomyelins develop from the transmission of the residual phosphocholine of the PC to ceramide. If this transmission comes to a hold, the skin cell faces cellular death. Consequently, PC is not only influencing the skin aging process to a major part, but also has a major impact on skin diseases with a disordered ceramide metabolism like neurodermatitis or psoriasis.

### Robust skin

A further possible step to activate the skin consists in removing certain substances, a method which for instance is applied in all the different peeling procedures. This process stimulates the skin to increasingly regenerate new horny layer components. However, caution is recommended in cases where the skin genetically is low in barrier substances. This procedure even is contraindicated in case of sensitive and neurodermitic skin, a fact that also applies for alkaline salt baths which among others are designed to extract acids of the horny layer. The robust skin shows reactions of an increased regeneration of its acid layer whereas in cases of dry skin the barrier disorders even will increase. As a rule,

a continued application results in an adaptation of the skin.

The few examples cited show the vast potential of cosmetic treatments, even if today the biological clock cannot yet be brought to a hold. Due to the fact, that almost every skin needs an individually adapted treatment, the expertise of the beauty institutes plays an important role. A significant issue here is the professional consultation of customers. After years of appropriate care an older skin may have a comparatively radiant young appearance whereas an inadequate care on a long-term base may lead to premature skin aging.

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