Ceramides – lipids with multiple assignments

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In combination with other skin components ceramides form a natural barrier in the horny layer. They prevent the dehydration of the skin. There are new products which support the skin-own formation of ceramides.

Ceramides are widespread in the animal world but also in the flora. They are found within but also outside of the living cells. The human skin contains ceramides above all in the “mortar substance” between the dead horny cells of the stratum corneum, e. g. in the surface layer of the skin.
The mortar substance is piled up in form of so-called bilayers. Ceramides are embodied in the bilayers of the horny layer and together with further skin components they form the most important natural skin barrier. This natural barrier layer fights back foreign substances as e.g. soaps and aggressive substances. In their protective function they prevent the dehydration of the skin and the penetration of foreign substances. Typical cases for the application of ceramide-containing products are dry skin and in a narrower sense, skin protection, i.e. the prevention of skin disorders and skin diseases. Furthermore they are used for the hair care where they are integrated into the hair interstices.
Ceramides therefore are in the focus of attention of physiological cosmetic and dermatics. Although they are widespread, their isolation and processing usually is rather expensive.
Yeasts are a frequently used source. Alternatively, for some time a series of ceramide-like synthetical variants has been processed which are supposed to be effective as moisturizers.

Divided into classes

The natural ceramides belong to a family of substances with a large number of species and a multitude of biological functions. They are divided up in different classes which are labeled with Roman numerals and whose exponents on their turn may again vary in detail. Besides ceramide III above all ceramide I is an important component of the bilayer of the stratum corneum. To keep the skin healthy also biological subproducts of the ceramides, the sphingomyelines as well as their degradation products play a major role. In cases where the natural balance of these substances is disturbed, reactions like dry skin or pathological skin manifestations like dermatoses, neurodermatitis or psoriasis can be diagnosed. Only recently it was reported that a degradation product called sphingosin-1-phosphate impedes the cell proliferation of psoriasis. Very interesting is also, that within the balance of ceramides and sphingomyelines a well-known representative, phosphatidylcholine plays an important role as a mediator.
Phosphatidylcholine is the raw material for liposomes and nanoparticles and is well-known for its excellent skin care effects.
A characteristic of ceramide I is its high linoleic acid content, an essential fatty acid, which is vital for the body but can only be supplied over the nutrition or locally applied on the skin with the help of appropriate linoleic acid-containing products. In case of a linoleic acid deficiency ceramide I cannot be formed which results in dehydrated and scaly skin and skin barrier disorders like neurodermatitis (atopic dermatitis). The decrease of the linoleic acid content in the skin nearly is an indicator for atopic dermatitis.

Penetration with the help of carrier systems

The most elegant method to enrich the skin with linoleic acid und support the formation of ceramide I is integrating linoleic acid in the skin in form of liposomes and nanoparticles. Liposomes and nanoparticles penetrate very well into the horny layer where they form depots.
Very interesting is the fact, that ceramides, after being extracted from the skin may form liposomal structures together with other skin components. By the way, this is an indication, why liposomes and nanoparticles, which contain phosphatidylcholine as raw material, are very well integrated by the bilayers of the stratum corneum while the original skin structure remains intact.
Skin care products containing emulsifiers modify the bilayers and support the wash-out of skin-own substances during the skin cleansing, since the emulsifiers usually integrate in the skin where they remain effective.

Hence, it is rather useless to combine vegetable or synthetic ceramides in creams and lotions containing emulsifiers. If at all, they should be included in creams which are free of emulsifiers.

From cold-cream to DMS

Possibly the eldest exponent of emulsifier free creams is the cold-cream, the most recent is the DMS-cream (DMS = Derma Membrane Structure). DMS-cream contains structures which are similar to the bilayers of the stratum corneum. Therefore ceramides, DMS, liposomes and nanoparticles tolerate each other in almost any ratio and combination. Raw material for the DMS-cream is phosphatidylcholine which instead of linoleic acid contains palmitic and stearic acid, both in esterified form. Palmitic and stearic acid are also in the horny layer of the skin, whereas palmitic acid predominates. Interestingly, phosphatidylcholine shows properties which are similar to the properties of ceramides. It integrates in the skin barrier layers and just like the ceramides it is very resistant against exogenous substances. It is recommended to avoid occlusive components on mineral oil base for this concept as they slow down the formation of skin-own protection substances. This can be shown by artificially damaging the skin with adhesive tape strips (stripping). While the skin regenerates under normal conditions within 24 h, the regeneration process is considerably delayed if the skin is artificially covered.

Supporting the skin-own formation of ceramides

The skin-own formation of ceramides in their natural composition and surrounding can be supported e.g. with a DMS-cream that additionally contains liposomes, which are rich in linoleic acid, or nanoparticles.
While DMS builds up an immediate protection, is the formation of ceramide I delayed due to the release of linoleic acid from liposomes or nanoparticles.
Creams with this principle have proven successful for the treatment of dry skin and the supportive prevention of neurodermatitis.

New developments to come

As ceramides and phosphatidylcholine are not only playing an important role for the treatment of skin disorders (neurodermatitis, psoriasis) but also for the aging of the skin cells a multitude of new developments can be expected for the future.
One new development already is in sight: oleogels, like DMS-creams naturally free of preservatives, and besides phosphatidylcholine and essential fatty acids, they also contain a considerably higher percentage of fat.
In contrast to the traditional oleogels, these gels penetrate very fast and are not greasing. Their specific composition enables for the first time a combination with water soluble substances like e.g. urea. Liquid exponents of oleogels are suitable for ayurveda treatments, which are in great demand today.
All in all, the method of the indirect support of ceramides in the skin seems to gain acceptance which is a new landmark in dermatological cosmetic.

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