

# Membrane-containing barrier creams - protecting the skin with skin-related substances

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Skin care products should primarily support the protective function of the stratum corneum and, if needed, also assist in the recovery process. Accordingly these products should be called barrier creams; however this technical term rather is used in combination with skin protective products. The following report deals with today's barrier creams and their benefits for the modern skin care.

**B**arrier creams have been known for some time already and until a few years ago they served the only purpose of protecting the skin from external substances. Just to mention an example: Barrier creams for occupational applications in combination with aqueous media generally have high lipid content and are mainly based on water in oil emulsion (W/O). The lipid content impedes the penetration of water into the skin. On the other hand, low-fat hydrogels are used if the skin comes into contact with work substances like oils and lipids.

## Skin protection versus skin regeneration

Seen from the physical point of view these principles still apply today and there is a multitude of skin protection products on the market. However, there has been a significant change of focus recently as it has been realized that regeneration needs to be put on a level with skin protection, based on the knowledge that a strong protective function or "sealing effect" of W/O emulsions will obviously impair the natural regeneration of the skin. Evidently there is need for a sensible compromise. The objective here is to have barrier creams which avoid the sealing of the skin with a surface film and instead integrate their protective function into the natural protective system provided by the membrane structure of the stratum corneum. The existing natural protective principle will thus be supported and, if needed, also restored after the repair of externally caused damages. Thus, the homeostasis i.e. the natural balance of the skin will be preserved.

## Copied from the skin

Solving this problem is a quite demanding task as a number of requirements have to be met:

- The chemical composition of the products should correspond with or at least be similar to the membranes of the stratum corneum.
- Their physical structure has to be identical. This is the reason why emulsions are inadequate as they have a drop-like structure and as there is proof that they modify the natural membrane structure of the skin.

This problem can be solved by replacing the emulsifiers with substances like **ceramides**, **phytosterols** and also **hydrogenated phosphatidylcholine** which cooperate in forming membranes and can stabilize the oil and water phases of creams. Unsaturated natural phosphatidylcholine is less appropriate as instead of the necessary two-dimensional membranes it will build up the cellular shaped structures known from cell membranes and liposomes.

The membranes of the stratum corneum mainly consist of ceramides, cholesterol and palmitic acid. Cholesterol (animal) and phytosterols (vegetable) have a similar structure, that is why phytosterols are alternatively used in case animal raw materials are to be avoided. It is difficult for ceramides to penetrate into the skin and, apart from ceramide III which is gained from yeast; they are still quite expensive, even including their synthetic relatives. Hence only small amounts of ceramides are added to formulations.

The **lipid substances** resulting from the secretion of sebum glands may also be added to barrier creams. Shea butter is an appropriate ingredient as it contains lipid substances as well as phytosterols. Besides its membrane forming functions, saturated (hydrogenated) phosphatidylcholine also supplies palmitic and stearic acid, both released from the molecule by enzymatic cleavage. Adding palmitic and stearic acid to the cream formulation is not recommended due to the inappropriate transport features of the acids

unless the anion active stearate cream will be used which however is inadequate in this case. Besides shea butter, there are other lipophilic substances like squalane which is a hydrogenated form of squalene, the preliminary stage of natural cholesterol, as well as physiological triglycerides of vegetable origin.

### Additives are indispensable

Also membrane containing creams require a basic mix of additives. Whether the cream is provided with excellent spreading features and, on the other hand also has substantial sensorial properties often depends on **consistency agents**. Substances controlling the consistency are e.g. carbomer, xanthan gum and hydroxyethylcellulose whereas the latter mentioned is a favorite substance to eke out formulations and keep the product within a reasonable price range. As the consistency agents mainly are synthetic or natural polymers, i.e. substances with a high molecular weight, they will be retained on the skin surface after their application, producing a distinct gliding sensation after the skin gets in contact with water.

Consistency agents also influence skin hydration as specifically the polysaccharide units of both, the cellulose compounds and xanthan gum have water retaining effects.

Some barrier creams contain CM glucan, a polysaccharide which is gained from yeast and submitted to a carboxymethylation process in order to become water soluble. Besides its influence on the consistency CM glucan also has anti-inflammatory effects and thus accelerates the healing process as e.g. after laser treatments.

Preservatives and perfumes definitely are incompatible with the above mentioned barrier cream concept, since from the allergological point of view both the substance groups are not supposed to penetrate into the stratum corneum or even into deeper skin layers. The substances mentioned are mostly found in jar products as the specific handling involves a certain risk of contamination. Preservative free products in dispensers may easily keep for 30 months at least or even longer, including the length of time after opening the product.

### Adding an extra dose of active agents

Should additional **active agents** be added, it is recommended to observe the right dosage since they use the stratum corneum as their starting point and penetrate directly into the deeper skin layers. Frequently the marketing departments more or less insist on the addition of these substances and make use of their

advertising appeal as it is quite complicated to explain the effects of the cream bases in sales messages and still more difficult for the consumer to understand them.

All the more important is the information that membrane containing base creams and active agents may be applied as a modular system which means that an individually adapted combination of active agent concentrates like sera and ampoules may be locally applied on problem areas before the barrier creams are used or alternatively mixed with the creams following a thoroughly carried out professional skin analysis in the beauty institute. It has to be considered though that this might modify the character of the barrier creams, or in other words, reduce the original protective function for the benefit of a specific effect.

By adding oils barrier creams may be adapted to seasonally required higher lipid contents. Barrier creams with high oil content will be applied on low fat skin, and in combination with moisturizing substances (NMF) also on low fat and dry skin. On the other hand, a minimum content of oil or even a light or short-chain oil is used on oily skin. The base oil frequently is a medium-chain neutral oil (MCT) or caprylic/triglyceride which can easily be replaced by other oils such as olive oil.

Due to the skin-like composition barrier creams are still able to assimilate aqueous and oily substances; this corresponds with the analogous behavior of the skin.

### Specific manufacturing process

The manufacturing process of barrier creams completely differs from the normal emulsifying process. The manufacturing involves several steps of high-pressure homogenization of the components. This process results in a characteristic leaf-shaped membrane structure which, on close examination with the regular microscope appears more or less without any structure and significant details can only be detected by means of freeze fracturing and the following use of the electron microscope.

Products with distinct lamellar structures which can already be seen with the help of transmitted light under the regular microscope have absolutely nothing in common with the membranes of barrier creams. These are just streak-like structures which can also be observed in stearate containing O/W emulsions. The INCI list will provide the respective information here.

### Matching deco products

If barrier creams are applied in combination with makeup products, it is recommended that

they are compatible and have a similar structure. In this case, the lipid content of barrier creams will be increased in order to improve the receptivity for pigments whereas on the other hand, the creams are still kept free of mineral oils and paraffins in order to allow the skin regeneration process below the makeup layer. The fascinating idea behind this specific system is to treat particular problem areas such as bad skin with the help of liposomes for example, to apply a protective cream and in addition to that to achieve the desired optical effects with the makeup finish. If needed, also a powder based on the same principles may be applied.

### **Further applications**

Membrane containing barrier creams are increasingly used in corneotherapeutic and dermatological treatments against barrier and cornification disorders. Active agents are, among others, amides like palmitamide MEA, stearamide MEA, urea and allantoin. These substances have antipruritic and some of them also anti-inflammatory effects. Palmitamide MEA can be naturally found in the epidermis. For cosmetic applications there are also slightly modified barrier creams like cleansing creams and cream masks on the market.

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