

# skin|aquaporins

## channels that facilitate hydration to the cell

**HOW IS SKIN'S LEVEL OF HYDRATION** measured? This is a commonly asked question by skin care professionals and consumers alike. To answer it, many factors must be taken into account, including dietary habits, water intake and lifestyle choices. Smoking, excessive alcohol consumption, poor diet and unprotected sun exposure all

out of the cell. Other small molecules including carbon dioxide, nitric oxide, oxygen and ammonia gas are capable of penetrating through these channels. They were discovered, more by accident than intent, by Peter Agre of Johns Hopkins University in 1992. In 2003 he was awarded the Nobel Prize in chemistry for this discovery. Recent work has

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affect not only the outward appearance of the skin, but also its ability to maintain proper hydration levels. We know the skin is a delicate balance of both water and oil soluble materials, modulated through processes like transepidermal water loss (TEWL), sebaceous secretions, the production of glycosaminoglycans in the dermis and ceramides by the keratinocytes. In fact, much of the focus of professional skin care revolves around this principle and maintaining these systems. One organelle in particular, the aquaporin, has become the focus of much attention in recent years for its role in maintaining this balance.

Aquaporins are protein channels that facilitate the transport of water across cell membranes, allowing water in and

shown aquaporins to be essential for the health of the body in general, but for maintenance of skin health in particular. Since the body is 70 percent water, regulation of the water content becomes a critical factor in the health of an individual. Continued research on the importance of aquaporins has shown that their expression is strongly affected by age, chronic sun exposure and abnormal osmotic equilibrium in the epidermis. There are at least 13 different types of aquaporins that can be found functioning within the cells of the brain, heart, kidneys, skin and other organs. There are six different aquaporins found in the skin, which are expressed in different skin cells. They are designated by the numbers AQP-1, 3, 5, 7, 9 and 10.



In the keratinocytes, the most abundant cells in the skin, types 3 and 10, are most prevalent. These two types have been designated as aquaglyceroporins, since they also allow for the passage of glycerin into and out of the cell. One of the additional functions of AQP-3 is to transport glycerol to help maintain the moisture level of the epidermis. It is this property that has led them to be designated as intrinsic hydrators. An interesting finding was that the absence of AQP-3 was associated with eczema, intercellular edema in the epidermis and sebaceous hyperplasia. Defects in the AQP-3 aquaporin can result in dry skin and other skin abnormalities. In psoriasis, there is decreased aquaporin expression in both the early and late stages of the disease. As a result, the water loss is increased with the decrease in skin hydration. Epidermal hydration seems to be one of the main functions of the aquaporins. Medical and cosmetic scientists are looking to take advantage of this new finding by developing agents that are capable of increasing the number of aquaporins in the skin. Recent research has shown that the topical use of caffeine has the ability to increase the expression of AQP-3.

Demonstrating a further extension of peptide use in skin care, acetyl hexapeptide-37 (Diffuporine™) has been clinically shown to increase AQP-3 expression.

pression, which subsequently enhanced skin hydration by 131 percent. Angico (*Piptadenia colubrina*) extract has been shown to increase the expression of AQP-3, 9 and 10.

Within the foreseeable future, skin care practitioners will have newer methods of measurements for skin hydration in their treatment rooms. For a diagnostic evaluation of a client's needs, estheticians are encouraged to rely on their most valu-

able assessment tools—their hands, eyes and ears—looking at the skin, feeling its texture and listening to the client. ■

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