THE SCIENCE OF SKIN HYDRATION
A SCIENCE WRITER’S GUIDE
Fresh, smooth and supple skin is the hallmark of healthy, hydrated skin. Unfortunately, millions of women suffer from dehydrated skin, which looks rough, uneven and dull.

Skin is exposed to a barrage of environmental stressors that compromise hydration on a daily basis — from over-cleansing to temperature extremes. So it’s no surprise that skin can easily look dull. But many women don’t realize that all skin types — whether dry, oily or combination — can be dehydrated or that maintaining skin hydration goes well beyond the use of a daily moisturizer. Many steps working together can add up to long-term hydration, such as infusing skin with natural hydration ingredients, maintaining cellular organization and then sealing in water to prevent dehydration.

New research has identified the process by which water enters and hydrates the deepest surface layers of the skin. Inspired by Nobel Prize-winning research on the function of biological water channels called aquaporins, ARTISTRY™ scientists have unraveled the complexity of skin hydration and developed technologies to help restore skin’s natural hydration process. This guide details the physiology of skin hydration, the signs of skin dehydration and new technologies to restore hydration, with the goal of educating the reader on how the ARTISTRY brand has developed a solution to improve skin’s outward vibrancy.
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THE BASICS OF SKIN HYDRATION

Hydration is critical to achieving ultimate skin wellness. Aesthetically, dehydration may be most noticeable in the skin. Deeply hydrated skin looks vibrant, smooth, healthy and fresh; dehydrated skin feels tight and uncomfortable and appears dull, rough, flaky or red. Beneath the skin’s surface lie many vital cellular elements involved in maintaining a fresh outer complexion of healthy hydration.

The outermost layer of the skin, the epidermis, forms a protective outer layer. About as thick as a sheet of paper (~0.1 mm) in most parts, the epidermis has several layers of cells that are constantly sloughed off and renewed. The majority of cells in the epidermis are called keratinocytes (figure 1).

The epidermis is made of multiple layers. Starting at the bottom, the basal layer consists of column-shaped cells, within which lies a network of water-transporting membrane proteins called aquaporins (see figure 1). These proteins form an aqueduct-like system that transports water from cell to cell to keep skin well hydrated. Thus far, ten types of aquaporins have been identified. Of these, aquaporin-3 (AQP3) and aquaporin-8 (AQP8) have been specifically identified in the skin for their importance for cellular hydration.

As we move up in the layers of the epidermis, above the basal layer, keratinocytes are held together in well-organized patterns by cell-to-cell adhesions called tight junctions (figure 1). These junctions form the tightest connections between cells found in nature. In addition to sealing in water, these junctions also control which molecules are allowed to pass between them.

The upper-most layer of the skin is the stratum corneum, which forms a critical barrier to the body’s external environment. The cells in this layer, called corneocytes, are derived from keratinocytes that have died and flattened out in layers or sheets (figure 1).

Surrounding the corneocytes is a matrix of lipids and natural moisturizing factors (NMFs) that help form the epidermal barrier. The main lipid found here is ceramide, which acts as the “mortar” to hold corneocyte “bricks” in place within the skin layer. NMFs are critical to maintaining water levels within the stratum corneum. While optimally hydrated skin contains up to 15 percent water in the upper layer, dehydrated skin contains less than 10 percent water. Water and NMFs together increase skin’s suppleness, due to the ionic interaction between the keratin within corneocytes and NMFs.
DEHYDRATED SKIN

When the biological processes that promote skin hydration are less than optimal, the result can be dehydrated skin. Millions of women experience dehydrated skin at some point in their lives due to exposure to environmental stressors, such as hot or cold temperatures, air conditioning, heating, daily cleansing and stress.¹⁰

Facial skin is constantly exposed to these environmental stressors. Damage to the skin from environmental stressors can begin as early as the teenage years, although the impact of this damage may not be visible until later in life (figure 2). Some of the most visible damages include dry, dull, rough and tight skin as well as fine lines that become visible around the eyes.

It’s important to note that dehydrated skin is not the same as dry skin. Dry skin lacks sufficient oil. Conversely, dehydrated skin lacks optimal water content. While dry skin is often also dehydrated, even oily skin may be dehydrated, due to a lack of water, not oil. Without this moisture, dehydrated skin looks dull, uneven and lifeless.¹⁰

Fortunately, the ARTISTRY brand’s new state-of-the-art technological approach is designed to re-hydrate skin to keep it looking fresh and young.

**FIGURE 2 | SIGNS OF DEHYDRATED SKIN APPEAR EARLY ON AND BECOME MORE NOTICEABLE WITH TIME**
TECHNOLOGY OF SKIN HYDRATION

The Nobel Prize-winning research of Dr. Peter Agre, who first discovered aquaporins, has inspired ARTISTRY researchers to find new ways to improve skin that has lost its optimal hydration. With the critical function of aquaporins in mind, researchers developed a three-step approach to rehydration based on skins' cellular physiology: infusing the skin with the purest hydrating water, organizing cellular components in the epidermis and sealing the outer skin barrier of the stratum corneum.

STEP ONE: INFUSE SKIN LAYERS WITH WATER

Hydration is impossible without the key ingredient, water. To ensure optimal hydration, ARTISTRY researchers have developed a technology that encapsulates Norwegian Fjord Water within a liposome. The exclusive liposome is a vesicle composed of a lipid membrane specifically designed to deliver key ingredients through the stratum corneum and into the deepest surface layers of skin, where it is needed most.

Resulting from glacial formations 10,000 years ago and considered among the purest of waters, the Norwegian Fjord Water is naturally filtered through quartz sand. The exclusive Norwegian Fjord Water-filled liposome also contains humectants (water-attracting ingredients), such as sodium hyaluronate and glycerin.

STEP TWO: ORGANIZE CELLS OF THE EPIDERMIS

After delivering hydrating ingredients, skin can be further improved through technologies that manage cellular hydration by organizing the cells of the epidermis. These technologies optimize skin aquaporins, tight junctions and the barrier function. To that end, ARTISTRY researchers have identified the following ingredients, which are incorporated in our formula to improve skin hydration.

- **Pink Himalayan Rock Minerals**
  Mined from ancient sea salt deposits within the Himalayan Mountains, Himalayan Pink Rock Minerals contain nine essential minerals crucial to skin health. Known for their high capacity to be assimilated by the body and sought after for their therapeutic properties, these nutrient-rich skin-replenishing minerals help to maintain and promote hydration within the skin.\(^4\)

- **Salicornia Herbacea Extract**
  To boost aquaporin function, researchers have identified Salicornia Herbacea extract, which is derived from a salt-tolerant plant that grows in marshes and mangroves. This extract boosts production of aquaporins AQP3 and AQP8 and increases the synthesis of amino acid building blocks that form NMFs.\(^4\)

- **Purified Peptides**
  For improving skin barrier function and optimizing cellular organization, yeast extract rich in purified peptides was selected. The extract is derived from a strain of baker’s yeast that has a known effect on calcium within the skin, which helps to promote the maturation of keratinocytes into corneocytes. It also reinforces the cohesion and stratification of the epidermis, thereby contributing to better organization of the stratum corneum.\(^4\)
• Lilyturf Extract
To maintain the skin’s barrier function and prevent water loss, ARTISTRY researchers turned to Lilyturf extract, which comes from a drought-resistant Japanese plant called ophiopogon tubers. This extract is known to trigger the formation of tight junctions, thereby preventing water leakage from between cells. It also boosts NMFs, which act as natural humectants within the stratum corneum.⁴

**STEP THREE: SEAL THE OUTER SKIN BARRIER**

Once hydration is delivered and the skin’s organization is optimized, the key to locking in this hydration is sealing the outer barrier of the skin. To create an optimal seal, ARTISTRY scientists turned to Hawaiian Acai Berry extract, which is rich in antioxidants and fatty acids such as linolenic, linoleic and oleic acids.⁴ Acai Berry extract is known for its ability to absorb and retain water molecules, thereby building hydration in the outer barrier.⁴ Additionally, the ARTISTRY formula includes an exclusive liposome containing ceramide — the main lipid known to fortify the brick and mortar configuration of the skin’s barrier.⁷ This exclusive moisturizing liposome seals hydration in the stratum corneum.

3 STEPS

Step 1 INFUSE SKIN LAYERS WITH WATER

Step 2 ORGANIZE CELLS OF THE EPIDERMIS

Step 3 SEAL THE OUTER SKIN BARRIER
CLINICAL FINDINGS

CELLULAR ORGANIZATION IN TREATED SKIN

The ARTISTRY brand has now combined the key natural ingredients described above into a hydrating formula. Clinical tests on 20 healthy women between 21 and 45 years of age have demonstrated the hydrating capability of this formula on the stratum corneum.

To mimic dehydrated skin, a mild detergent was used to disrupt volunteers’ skin. The formula was then applied to the disrupted skin twice daily for 28 days. Two skin characteristics of the stratum corneum that define hydrated skin were examined: cellular organization of the stratum corneum, as measured by confocal microscopy images, and water retention, as measured by transepidermal water loss (TEWL).

To examine skin organization, confocal microscopic images of the stratum corneum were taken. Normal, healthy skin contains hexagonal cells arranged in a honeycomb formation (figure 3A). In the deteriorated skin barrier, after treatment with the detergent, cells were more rounded and attained a scale-like formation (figure 3B). But cell shape and arrangement became progressively more hexagonal and honeycombed after skin was treated with the ARTISTRY test formula for 14 (figure 3C) and 28 days (figure 3D).

![Cellular Organization in the Epidermis](image)

\(^{1}\)Study tested the ingredients listed in Step 2: organize cells of the epidermis.
The results of the confocal microscopy demonstrated significant improvement compared with placebo. After 7, 14 and 28 days of treatment, significant improvements of 14.7, 18.7 and 20.9 percent, respectively, were observed in the cellular organization of the stratum corneum (figure 4).

**FIGURE 4**  CELLULAR ORGANIZATION IS IMPROVED IN SKIN TREATED WITH ARTISTRY HYDRATING FORMULAT

*Significant results vs. placebo according to Student’s t test (P<0.05)

†Study tested the ingredients listed in Step 2: organize cells of the epidermis.
WATER RETENTION IN TREATED SKIN

The quality of the skin’s barrier function in the stratum corneum can be measured by testing its ability to retain water, as measured by TEWL. Healthy, hydrated skin with a strong barrier function loses less water and thus is characterized by a lower TEWL value.

Clinical analysis of the 20 volunteers showed that TEWL was significantly reduced by 17 percent after 14 days and by 18.9 percent after 28 days of treatment with the ARTISTRY formula compared with placebo (figure 5).\(^4\)

The TEWL study and confocal images together demonstrate significant improvement in cellular organization within the stratum corneum (figures 3 and 4). The TEWL study also showed significant reduction in skin water loss after two weeks, with further improvement after four weeks. These results are due to an intact stratum corneum and a restoration of a healthy epidermis.

**FIGURE 5** | REDUCED WATER LOSS IN SKIN TREATED WITH ARTISTRY HYDRATING FORMULA\(^1\)

<table>
<thead>
<tr>
<th>Variation / Placebo (%)</th>
<th>D7</th>
<th>D14</th>
<th>D28</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4.0(^%)(^{ns})</td>
<td>-17.0(^*)</td>
<td>-18.9(^*)</td>
</tr>
</tbody>
</table>

*Significant results vs. placebo according to Student’s t test (P<0.05)
ns: No significant result vs. placebo.

\(^1\)Study tested the ingredients listed in *Step 2: organize cells of the epidermis.*
24-HOUR MOISTURIZATION STUDY

The effect of the ARTISTRY hydrating technology on moisture content in the stratum corneum was also measured by electrical capacitance, which increases as the skin becomes more hydrated. Thirty-one adult female volunteers with clinically determined mild-to-moderate dry skin completed the study (figure 6). The findings revealed that treatment of the dry skin improved hydration of the stratum corneum for up to 24 hours after a single application, as evidenced by statistically significant increases at all tested time points (8, 12 and 24 hours after application). Untreated skin had no significant improvement.\(^4\)

In summary, results measured by confocal imagery, TEWL and electrical capacitance demonstrated that the ARTISTRY hydrating technology helped restore the barrier function of the stratum corneum, reduce water loss and improve hydration in dehydrated skin.

FIGURE 6

**IMPROVED HYDRATION IN DRY SKIN TREATED WITH ARTISTRY HYDRATING TECHNOLOGY\(^7\)**

<table>
<thead>
<tr>
<th>Percent Increase in Hydration vs. Time</th>
<th>Treated</th>
<th>Untreated</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Hours</td>
<td>49.10</td>
<td>-7.60</td>
</tr>
<tr>
<td>12 Hours</td>
<td>51.40</td>
<td>-4.10</td>
</tr>
<tr>
<td>24 Hours</td>
<td>34.30</td>
<td>3.60</td>
</tr>
</tbody>
</table>

\(^1\)Study tested ingredients listed in Steps 1, 2 and 3.
CONCLUSION

The ARTISTRY technology, combined with rare ingredients, has been clinically proven to rehydrate skin by optimizing the skin’s natural hydration process.

In the first step, the exclusive liposome quenches the skin with pure Norwegian Fjord Water, delivering an immediate refreshing feeling.

The second step includes key ingredients such as Himalayan Pink Rock Minerals, which replenish the skin by increasing skin’s aquaporins, improving water transport between and within cells, restoring healthy cell shape and organization and strengthening tight junctions. Together, these effects result in optimal hydration levels throughout the skin.

The final essential step revitalizes skin’s ability to seal in hydration by strengthening a healthy moisture barrier. Hawaiian Acai Berry extract and the exclusive ARTISTRY moisturizing liposome promote a tight seal between cells in the stratum corneum, so moisture is retained within the skin.

Now, with this technology, the millions of women around the world who have dealt with dehydration can benefit, no matter their age or skin type. ARTISTRY hydrating formula can bring women of all ages with dry, combination or oily complexions deeply hydrated skin that feels soft, smooth and supple and that looks vibrant, radiant and fresh.
REFERENCES

1 The 2003 Nobel Prize in Chemistry-Popular Information. Nobelprize.org. 10/08/03.


4 Data on file.


