

Alpha-Hydroxyacids, Polyhydroxy Acids and Bionics

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The alpha-hydroxyacids (AHAs) have transformed skin care and therefore have enjoyed huge commercial success since their introduction into skin care by dermatologist, Dr. Eugene J. Van Scott, and skin biochemist, Dr. Ruey J. Yu in the early 1970s. It's hard to believe that 30 years have passed since the first benefits of AHAs were published, demonstrating their nearly miraculous, 'normalizing' effects on severe, dry skin and ichthyosis. After relentless teaching of their benefits for more than a decade, the first AHA containing product, the prescription Lac-Hydrin[®], was launched in the mid-1980s. Then came the observation that AHAs can help to *reverse* signs of aging skin, and voila...the health and beauty market took off growing exponentially starting with the first product in the category, Avon's Anew[®].

Now it's hard to find a company that has not launched an AHA containing skin care product or a person who has never heard of the AHAs. Their reputation as exfoliants, anti-aging ingredients and skin brighteners has garnered them a lead position in the market, well ahead of any competitive technology. AHAs remain one of two ingredients with substantial clinical and scientific evidence that they can reverse the signs of dermatological aging. The other is retinoids. But, many of their other, important skin benefits are not understood by many consumers, or even skin care specialists. To add to the confusion, there are newer polyhydroxy AHA and bionic acid compounds. These ingredients provide the anti-aging and skin smoothing effects of AHAs with many added benefits, including gentleness – the one feature that *seems* to have escaped the AHAs. There are new, more targeted AHAs, enhanced AHA technologies and even non-acid ingredient technologies being discovered that promise similar anti-aging effects.

AHAs Can Do *What?*

Glycolic acid and lactic acid are the two most commonly used AHAs in cosmetic and therapeutic skin care products, regardless of whether the products are found in a food store or department store, sold by estheticians in spas and salons, or used and dispensed by dermatologists and plastic surgeons in their practices. **Glycolic acid and lactic acid** have earned the reputation as being the 'workhorses' in AHA skin care. Rightfully so, aside from their demonstrable benefits on skin turnover and exfoliation, these ingredients have been shown to reverse some of the histological signs of photoaging in the dermis – where **wrinkling and sagging** actually occur. Studies have demonstrated a reversal of abnormal cell structure that results from cumulative sun exposure, as well as increased collagen levels and the water-binding glycosaminoglycan (GAG) substances, for example hyaluronic acid. Solar elastosis, a condition primarily characterized by a proliferation of abnormal, globular elastic fibers that are incapable of stretching, can be reversed with AHA use leading to the development of normal, healthy elastic fibers and the resulting increase in skin elasticity. Wow, who knew the AHAs could do all of this?

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These agents also promote **epidermal normalization**. This is important because the epidermis is responsible for generating a protective skin barrier on a daily basis. An unhealthy epidermis causes diminished barrier function, dehydration, scaling, flaking and roughness. The melanin-producing pigmentation cells reside in the epidermis too. Cumulative exposure to sun causes abnormal behavior by these cells, leading to the development of sunspots and age spots. AHAs have been shown to ‘normalize’, that is to make normal, the epidermal structure, promoting more even pigmentation and a healthy stratum corneum. Both the epidermis and dermis benefit from AHA use.

Toning Down the *Stinging*

It’s an undeniable fact that most of the effective AHA products on the market are also the one’s causing the stinging and burning to many sensitive skin consumers. It makes sense, AHA products need to contain free acid (not neutralized) to penetrate and have significant benefits on skin. The small molecules of glycolic and lactic acid in their free acid state, get into the skin quickly and often elicit a stinging and burning effect. What can be done to temporarily tie up the acid and slow down penetration without actually neutralizing it all? There is an answer. Patented **amphoteric technology** provides this effect, and the resulting benefits offer advancement in AHA skin care. Amphoteric amino acids, such as arginine and glycine, can be used during the formulating process to help adjust pH and form a temporary complex with the ‘free’ glycolic acid. The result – reduced stinging, reduced irritation and retained effectiveness.

AHAs That Love *Oily* Skin

Traditional AHAs, including glycolic acid and lactic acid, are highly polar, water soluble materials. **Lipophilic AHAs** also exist, and they offer benefits on oily and acne prone skin because they can preferentially absorb into the oil rich follicles. **Mandelic acid** (glycolic acid with a phenyl group attached) and benzylic acid (glycolic acid with 2 phenyl groups attached) are two examples of AHAs with enhanced oil solubility. These agents have demonstrated anti-acne benefits, and improvements in rosacea, perhaps due to absorption into the oily follicles and the resulting normalization of keratinization in this microenvironment.

Anti-AHAs...Anyone Need *Thicker* Skin?

Some acetylated forms of AHAs, such as **acetyl mandelic acid**, have effects on skin and nails that are *opposite* to the effect of AHAs, that is they actually promote the accumulation of surface cells. It’s easy to imagine the benefits of these compounds on thin, layered nails, a condition clinically referred to as onychoschizia. With regular use, nails become harder and thicker. Perhaps there is a use in skin as well to *promote* the formation of calluses. Golfers, weight lifters, and runners, are just a few that could benefit from this effect.

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What's New...Polyhydroxy Acids (PHAs) – Are They *Better* than AHAs?

After the discovery of the AHAs, continued research led to the use of new polyhydroxy acids, including gluconolactone and glucoheptonolactone. Considered the “**next generation**” of AHAs, these compounds provide some *unique benefits* that other, traditional AHAs do not offer. For example, many of the PHAs are antioxidants, functioning as chelators, which trap metals that can have a pro-oxidative effect. Some testing models have demonstrated that gluconolactone can prevent the oxidation of other substances similarly to ascorbic acid (vitamin C) and citric acid. Due to their multiple hydroxy groups (thus the name polyhydroxy acid), these compounds are humectants that attract and bind water. In this regard, their effect is similar to other known humectants, glycerol and propylene glycol. Perhaps one of the most important benefits of the PHAs is their gentleness. When compared to glycolic acid and lactic acid, PHAs are *non-irritating and non-stinging*. Studies have demonstrated their compatibility with sensitive skin, even on rosacea and atopic dermatitis. These compounds are well suited for use in the burgeoning post-procedures market, i.e., microdermabrasion, superficial glycolic acid peels and nonablative laser, as a result of the antioxidant and hydration effects in combination with their gentleness.

There are also important benefits to skin health and safety. Glycolic acid and lactic acid have been shown to increase the skin's sensitivity to sunlight necessitating the use of sunscreens in combination with AHAs during the day. (A low SPF has been shown to prevent any increase in sun sensitivity by AHAs.) PHAs have been shown *not* to have this negative effect on skin. Other studies have demonstrated another important difference; PHAs can actually *strengthen* skin barrier function against an external irritant.

But do gentle PHAs have strong anti-aging benefits? Multiple research studies have demonstrated *significant anti-aging effects*. PHAs smooth skin, diminish the appearance of pore size and wrinkling, and improve elasticity, firmness and clarity. Formulated in much the same way as AHAs, PHA products include cleansers, toners, moisturizers, anti-aging treatments, serums and daily use lotions with sunscreens. A recent study comparing the anti-aging effects of AHA and PHA products demonstrated comparable levels of effectiveness over the twelve-week testing period, with improved mildness characteristics in the PHA treatment group.

Lactobionic Acid...Now That's Something New

The *next* “next generation” AHA is yet another step ahead of the AHAs. This unique compound is derived from milk sugar, and is a **polyhydroxy bionic acid**. It is extremely hydrating, even film-forming. Once hydrated, it never dries to a powder because it holds water so tightly that a gel forms during the dehydration process. All of this provides a *light occlusive effect* on skin and silky smooth aesthetics. This compound has potent metal chelating (binding) properties making it a strong anti-oxidant. (It is currently being used as an anti-oxidant preservative for organs during transplantation procedures.) Metal chelation has another important effect...diminished metallo-proteinase enzyme activity in skin. Activation of these enzymes is largely responsible for the degradation of collagen

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in skin after sun exposure. Indeed, lactobionic acid formulations have been shown to provide significant benefits on the appearance and feel of photoaged skin, but actual *prevention* of the photoaging process remains to be seen.

Lactobionic acid is ideal for use post-procedurally. It is non-irritating and very hydrating. It is an antioxidant that may also promote healing. When formulated in an occlusive type vehicle, this compound provides a blanket of moisturization on skin. In addition, it helps *extend the benefits* of cosmetic procedures. Both microdermabrasion and superficial peels diminish skin barrier function. Topical application of a non-irritating bionic PHA enhances skin benefits by providing AHA effects on cell turnover, pigmentation normalization and collagen and elastin building. Lactobionic acid is a **breakthrough technology** in skin care.

In a Nutshell

The *alpha-hydroxyacids* continue to be used extensively in the fight against photoaging and for adjunctive therapeutic effects in clinician's offices. Use of patented *amphoteric formulation* approaches can improve their side effect profiles, while maintaining strong clinical effects. New, more *lipophilic AHAs* will be seen more in the future when targeting oily skin. The *polyhydroxy acids* are a tremendous advantage in skin care. Offering all of the anti-aging benefits of AHAs, these hydrating compounds are also anti-oxidants, barrier conditioning, gentle and safe. Lactobionic acid, one of the *bionic PHAs*, is a unique compound with strong water binding effects, anti-oxidant properties and skin smoothing benefits.