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The Ingredients *Column*

Cellular Detoxification: Intervention and Beyond



by Diahne
Patnode

Mother Nature, the creative genius with millions of years of research and development history, is an inspiration for technology across a wide array of industries. By mining into the abundant information of biological systems while utilizing nature's tools and flow of ideas, a path for the creation of new innovation emerges. Biotechnology has a strong presence in skin care advances that is achieved from the distillation of nature's ideas and principles, which then offers a vast range of solutions.

Biomimetic Peptides

One of the strongest forces in biologically-inspired personal care actives are peptides. Biomimetic compounds, especially peptides, can be synthesized for a targeted action that will activate the desired response. Significant scientific research is required to identify the correct strategy from the wide variety of natural processes. Once identified, the natural processes can be either highly specific or less evolved by modifying the ingredient chemically for varied efficiencies. Additionally, similar chemical structures can mimic biological functions in specific organs, such as the skin.

Acetyl tetrapeptide-2, by Lucas Meyer Cosmetics is a biomimetic peptide derived from the youth hormone, thymopoinetin. With a chemical structure similar to the youth hormone, the skin immune defenses are stimulated. In vitro testing indicates the ingredient has a role in stimulating the skin defense system and reduces the inflammatory response. Clinicals conducted with a histological analysis showed an improvement of the epidermis with an increase in thickness and restoration of the dermal papillary pattern.

Biomimetic peptide hexanoyl dipeptide-3 norleucine acetate by Mibelle Biochemistry is a biologically active peptide which reactivates the natural desquamation process of the skin. The peptide contains the cell adhesion recognition (CAR) sequence and was coupled with Mibelle's signature liposomal encapsulation system to increase penetration into the stratum corneum. The ingredient specifically breaks the bonds between dead cells at the surface of the skin, thus reactivating and balancing the desquamation process. By revealing new surface cells and speeding up cell renewal, skin texture is refined by a reduction in wrinkles, improvement in skin hydration, and uniformity.

Agonist and Antagonists

With combinations of science and nature, biomimetic ingredients can be selected and designed to act as "keys" to turn on or off receptors. Two functions of these "keys" are named agonists and antagonists. The agonists work to produce actions, while the antagonist works in opposite, opposing the action by shielding or preventing the action

Induchem USA, Inc. has extensively researched skin cell receptors that control and reverse the aging processes. Induchem's biomimetic active, hexapeptide-48 HCl, is an ingredient that acts as a delta opioid receptor (DOR) agonist. The produced agonist action at the DOR receptor stimulates the expression of differentiation markers that are directed towards aging skin and change the gene expression of inflamed cells back to their normal state. In vivo clinical studies yielded a perceptible reduction of wrinkles, reduction on wrinkle depth for smoother skin, and lower transepidermal water loss for better skin hydration.

As an antagonist, nonapeptide-1 by Lucas Meyer is a biomimetic oligopeptide specific for alpha-melanocyte-stimulating hormone (α -MSH). The antagonist action of inhibiting the receptor action is achieved by competing for, then occupying the receptor site. Like musical chairs, the peptide occupies the receptor site and the melanocortin 1 receptor is unable to sit in the receptor site seat. By interrupting the melanogenesis pathway, overexpression of melanin is prevented, offering better control of overall skin tone and age spots.

In principle, biomimetic ingredients can be reverse-engineered and made to respond naturally with preferred performance and efficacy as the natural compound that it mimics.

In a targeted action with no systemic effect, bakuchiol by Sytheon Ltd., is a natural retinol-like function ingredient. Reti-

nol is a pivotal regulator of gene expression through retinoic acid receptor pathways. Bakuchiol not only provides similar gene expression without the negatives of retinol, but is also a way to benefit skin without using synthetic vitamin A. In vivo testing included clinical evaluations and self-perception studies, both proving a reduction in skin wrinkle depth, roughness, and dryness. Bakuchiol has further clinical studies proving anti-inflammatory properties, use as a stabilizer for retinol, a down regulator of inflammatory genes, and proof of significant improvement of acne conditions.

Sederma's ingredient possesses a structure similar to hyaluronic acid. The ingredient is obtained by biofermentation to fabricate a sequence of acetylated glucuronic acids (hydrolyzed yeast extract, cetyl hydroxyethylcellulose, polyglucuronic acid, lecithin) that resemble the fragments of hyaluronic acid. Stimulation of CD44, a cell receptor involved in hyaluronic acid anchoring and turnover, allows an efficient cutaneous water network and sustains the self-renewal of hyaluronic acid. In vitro studies indicate hyaluronic acid formation and an increase in elastin synthesis. In vivo studies show significant smoothing of wrinkles, moisturization, and skin suppleness.

Antioxidant Activities

Reactive oxygen species are toxic molecules implicated in several processes including tissue injury, inflammation, and aging. Multiple ingredients are available with comparable antioxidant capacity without negative interactions with cells.

Ashland Inc.'s dipeptide-4 is a glutathione-biomimetic antioxidant peptide that protects against glycation damage, offers protection from environmental stresses, and prevents loss of skin resiliency. As a glutathione-biomimetic antioxidant synthetic peptide, it helps preserve the skin from all kinds of oxidative stresses and improves the natural defense mechanisms against oxidative stresses (superoxide dismutase and catalase).

Ethylbisiminomethylguaicol manganese chloride is a biomimetic molecule of two natural skin enzymes, superoxide dismutase, and catalase. This multifunctional and powerful antioxidant scavenges free radicals by mimicking the activities of enzymes in the skin. Clinical testing demonstrates protection of skin tissue against toxic compounds, ultraviolet-induced DNA damage and reduced erythema and redness that can lead to premature photoaging.

Fatty Acid Biochemistry

Fatty acids, or triglycerides, are the fatty portions of fats and oils. Fatty acids (linoleic, oleic, stearic and palmitic) readily permeate both dry skin and assist greasy skin by exerting a proven sebum equilibrating action.

Linoleamidopropyl PG-dimonium chloride phosphate by Croda is derived from natural safflower oil that contains 80 percent of linoleic acid. The ingredient is an organic phospholipid complex designed to be biomimetic. Clinical tests demonstrate it to be substantive to the skin and effective at conditioning with mild and non-greasy emolliency.

Sodium borageamidopropyl PG-dimonium chloride phosphate by Colonial Chemicals is a recently-released, naturally-derived biomimetic phospholipid complex made from borage oil. Focusing on natural triglyceride phospholipids, this biomimetic is shown to enhance and augment the natural barrier system of the skin.

Lucas Meyer's ingredient, (INCI: phospholipids, stearic acid, palmitic acid) is a natural, hydrogenated sunflower with skin-identical lipids organized in a biomimetic lamellar structure. It performs as a protective second skin. Studies show a restored, reinforced barrier function that retains water for better immediate and long-lasting hydration.

Roscow Cosmetique's Polyquaternium-51 is a commercialized technology from the biomedical research industry. The biomimetic polymer is designed to mimic the structure of the phospholipid membrane. Film-forming properties on the skin exhibit long-lasting moisturization and protective properties.

There is certainly much to learn from Mother Nature's research and development. Awareness of potential beneficial effects from physical and chemical properties and identification of nature's symphonic processes leads to innovation that commands preferred performance and outcomes of personal care formulations. With biocompatible ingredients yielded from advanced synthesis processes, emergence of materials with the same expected efficacy as the natural compound with the benefit of avoiding systemic effects continues to grow. As Aristotle said, "Nature always makes the best of possible things."

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Diahne Patnode, director of research and development at YG Laboratories and expert cosmetic chemist, has over 25 years of progressive experience in formulating and developing trend-setting cosmetic products for some of the most recognized names in the industry, including Redken Laboratories, philosophy/BioMedic, and Arbonne International. After studying biochemistry at the University of Arizona, Patnode discovered the beauty industry and an insatiable curiosity for discovering the latest technological advances to create cutting-edge prestige products. Patnode holds multiple patents and as a leader in research and product development, she continues to provide insight that delivers market-leading products.

