PEPTIDES

By Rachel Grabenhofer and Katie Anderson

Peptides, derived from the Greek *peptós* meaning "to digest,"[1] are small protein molecules consisting of two to 50 amino acids; molecules with more than 50 amino acids are considered proteins. Peptides are often subdivided into oligopeptides—i.e., of just two (dipeptides), three (tripeptides), four (tetrapeptides), etc., amino acids, up to 20; or larger polypeptides with many amino acids. In fact, proteins are created by one or more polypeptides.

Peptides are native to practically all life forms and serve important biological functions, especially metabolism. Types of peptides include: plant, bacterial/antibiotic, fungal, invertebrate, amphibian and skin, venom, cancer/anti-cancer, vaccine, immune/inflammatory, brain, endocrine, ingestive, gastrointestinal, cardiovascular, renal, respiratory, opiate, neurotrophic and blood-brain, among others.[2]

According to the book *The World of Peptides*,[3] two or more centuries ago, proteins were first recognized as the primary building blocks of life, but the significance and broad-ranging roles of peptides in practically all of life has only been known for the past 50 years or so. Peptides are found in every cell in the human body.[4] They give structure to cells including collagen, elastin and keratin. They also are involved in complex processes such as cell signaling.

Exerting Action

In order for a peptide to exert activities, it must bind to a receptor that is specific for that peptide and located within the membrane of relevant cells.[4] Upon binding, the peptide prompts the receptor to activate entities in the cell to stimulate a series of biological events.

Signaling peptides mainly comprise: peptide hormones, neuropeptides and growth factors.[5] Also referred to as biopeptides, they function as messengers between cells. Growth hormones, for example, as their name suggests, stimulate growth. Insulin and glucagon also exemplify well-known peptide hormones, as well as human growth hormone (HGH), or somatotropin.[6]

Signaling peptides found in neural tissue are neuropeptides, and in contrast to closely targeted neurotransmitters, have diverse effects. Among other things, they can modify gene expression, local blood flow and the formation of synapses (think botulinum toxin).

Finally, peptide growth factors engage signaling to regulate animal cell growth, metabolism and differentiation.[5,7] Examples include epidermal growth factor (EGF), fibroblast growth factor (FGF) and others. While the term *growth factor* was used initially to describe secreted substances that enhanced cell division, this term now includes peptides that stimulate or inhibit the progression of cells through mitosis, as well as proteins that act principally to regulate cellular differentiation.[7]

Cosmetic Applications

Peptides are well-known for their utility in cosmetic and skin care applications. They have been used to stimulate epidermal and fibroblast growth, to reinforce the skin barrier and to intercept cellular messages to decrease muscle movement and soften the appearance of wrinkles.

A recent paper reviewed a multitude of benefits from plant- and microalgae-derived peptides for skin.[8] It noted that all plant and microalgae-derived peptides used in cosmetics and skin care are formulated as mixtures of many different protein fragments, obtained by the hydrolysis of larger proteins using either chemical or enzymatic approaches.

Based on the protein source and method of processing, different biological functions are possible. Examples included: *Avena sativa* (oat) enzymatic hydrolysates to reduce

oxidative stress-induced injury in skin fibroblasts; *Glycine max* (soybean) total lysates to improve wound healing by increasing ECM synthesis and promote cellular adhesion; *Triticum vulgare* (wheat) chemical/enzymatic hydrolysates to improve skin's healing capacity and impart anti-inflammatory effects; and *Arthrospira platensis* (spirulina) enzymatic hydrolysates to promote hydration in skin cells and counteract osmo
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Recently, one
supplier introdu
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anemone venom to soothe sensitive skin[a] by inhibiting the pain receptor TRPV1.[10]

Another peptide-based technology[b] based on a nona- or oligo-peptide was developed with the aim to "awaken the cells of the skin by activating their 'alarm clock.'" According to the ingredient supplier, this product was shown to increase the JARID1a protein and clock genes, in turn visibly improving skin's complexion through revitalizing and anti-aging activities.[11]

[a] *SensAmone P5 (INCI: Pentapeptide-59 (and) Hydrogenated Lecithin (and) Butyrospermum Parkii (Shea) Butter (and) Phenethyl Alcohol (and) Ethylhexylglycerin (and) Maltodextrin (and) Water (aqua)) is a product of Mibelle Biochemistry.*
[b] *Downenergy (INCI: Not Available) is a product of Lipotec.*

In the Spa

Peptides are alive and well in the spa, found not only in anti-aging treatments but in a myriad of services.

The Spa at the The Lakehouse Inn in Geneva-on-the-Lake, Ohio incorporates peptides into a number of its facials, including its Anti-aging Facial ($99).The treatment starts with cleansing and moves to exfoliating treatments containing plant-derived

Lift & Glow uses repairing peptides along with lightening actives and antioxidants to brighten, firm and rejuvenate skin. Oligopeptide-68 evens the skin tone and brightens the skin, while palmitoyl tetrapeptide-3 firms, smoothes and rejuvenates skin.

VoluDefine Rich from CelleCle utilizes three peptides: hexapeptide-38 HCl to increase cell communication to strengthen the barrier and

For example, Rhonda Allison combines palmitoyl tripeptide-38 and acetyl hexapeptide-30 in its Peptide 38 Serum to actively correct the signs of aging. Along with two MMP inhibitors, the peptides stimulate collagen activity, rebuild the skin, provide structural and antioxidant support, hydrate and smooth wrinkles.

products on the market.

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In Aesthetic Back Bar's Eye Renewal Serum, acetyl tetrapeptide-5, steareth 20-dipeptide-2 and palmitoyl tetapeptide-7 are combined with plant stem cells and echinacea to reverse the signs of aging around the eyes.

Pevonia's lumafirm Repair Cream

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10. www.cosmeticsandtoiletries.com/formulating/function/antiirritant/Mibelle-Biochemistrys-SensAmone-P5-562444691.html
11. www.cosmeticsandtoiletries.com/formulating/category/natural/From-Skin-Awakenings-to-a-Blue-Future-Lipotec-Innovations-Debut-508608921.html
All websites accessed on Jan. 24, 2020.

Rachel Grabenhofer is the managing editor of *Cosmetics & Toiletries*, *Skin Inc.*'s sister brand for cosmetic chemists. She's a member of the Council of Science Editors and Society of Cosmetic Chemists, and for the past several years, has led judging panels to honor the best ingredients in cosmetics.