

Skin Care after the sun

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Last month the author wrote about sun care with the emphasis on ways of maximising the potential of existing sun filters and providing protection from near Infra-red (IR) as well as UVA and UVB. This month the focus is on ways of mitigating the many unwanted effects of solar radiation on skin and hair.

Chronological ageing is the process of getting old through time; photoaging is the cumulative detrimental effects primarily visible as wrinkles or dark spots on skin that result from long-term exposure to the UV spectrum of sun light. UVB rays are the main cause of sunburn and UVA rays, with their longer wavelength, are responsible for much of the damage associated with photoaging. They penetrate deep into the dermis, where they damage the collagen fibres and cause increased production of abnormal elastin. The unusual amounts of elastin result in the production of matrix metalloproteinase enzymes, which often malfunction and degrade the collagen, resulting in wrinkles and a leathery skin.

According to the Canadian Dermatology Association [Ref 1] on sun exposed skin, up to 90% of skin aging is due to the deleterious effects of the sun. Effects are cumulative and sun damage manifests itself by the appearance of fine wrinkles around the eyes and mouth; frown lines on the forehead; spider veins on the nose, cheeks and neck and by forming various pigmented spots, such as freckles, solar lentigines and an uneven skin colour. There is a general loss of skin tone in sun exposed areas; lips start to lose some colour and fullness and eventually the skin becomes leathery and sags. There may be scaling and exposed skin may bruise more easily and red, rough scaly spots, called actinic (sun-related) keratosis, may appear.

There are two important regulators of collagen production: transforming growth factor TGF- β and activator protein AP-1. TGF- β is a cytokine that promotes collagen production and AP-1 is a transcription factor that inhibits collagen production and up-regulates collagen breakdown by matrix metalloproteinases (MMPs) enzymes. When skin is exposed to sunlight, UV radiation is absorbed by skin molecules that can generate reactive oxygen species (ROS), which then cause oxidative damage to cellular components like cell walls, lipid membranes, mitochondria, and DNA. AP-1 becomes elevated and collagen-degrading MMPs are also markedly elevated. In addition, UV irradiation leads to decreased expression of TGF- β 2, causing decreased collagen production. Increased breakdown and decreased production of collagen are the cornerstones of photoaging [Ref 2].

The major cause of chronologic aging is now believed to be Inflammaging, which describes the low-grade, chronic, systemic inflammation in aging. It is believed to be a consequence of a cumulative lifetime exposure to antigenic load caused by both clinical and subclinical infections as well as exposure to noninfective antigens. The consequent inflammatory response, tissue damage and production of ROS that cause oxidative damage also elicits the release of additional cytokines and this results in irreversible cellular and molecular damage that is not clinically evident but slowly accumulates over decades [Ref 3]. The free radical theory of aging proposes that aging results from accumulation of oxidative damage over a lifetime due to excess ROS, which result from aerobic metabolism, however, exposure to sunlight greatly speeds up these processes so both photoaging and inflammaging are most apparent on areas of skin exposed to the sun.

Ingredients that inhibit the formation of ROS have a significant role to play in combatting ageing in general and photoaging in particular. and that is the major claim for most of the ingredients on offer from suppliers. Many also claim to be anti-inflammatory and to protect DNA so can be regarded as multi-functional ingredients. An example is AFA-GS from **CR&D**; it is a selective extraction of a wild fresh water blue-green algae that grows in the Klamath Lake, a volcanic crater spring lake in South

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Oregon that is rich in trace elements. especially Fe, Zn, Se, Mg. The principal active ingredient is Phycocyanine-C, a chromophore complex made by the repetition of a protein and a tetrapyrrole aggregate with the ability to defend mitochondrial DNA from oxidation and exogenous and endogenous pollution. AFA-GS also includes vitamins, essential amino acids, alpha-linolenic acid and glyceryl glucoside. This latter material is responsible for hydrating the skin over an extended period. Tests undertaken by CR&D demonstrate its hydrating, antioxidant and anti-inflammatory properties and CR&D claims that because of these activities, AFA-GS is recommended for so-called "urban cosmetics" for people living in heavily polluted environments. The colour of the chromophore group in the blue light range can also give some protection against blue light radiation. Its INCI listing is glycerin, aqua, sucrose and Aphanizomenon flos-aquae powder.

Algae are an interesting source of cosmetic active ingredients. Lanablue from Lucas Meyer is an extract of cyanophyceae algae harvested in North America. It has a natural blue colour imparted by its content of phytosienine and a high content of group B vitamins and amino acids. It acts like natural retinoids on keratinocyte differentiation and is an inhibitor of MMP expression.

Protection against urban pollution has become an important claim in skin care. According to **Symrise** most anti-pollution strategies rely on the action of free radical scavengers, but recent studies have shown a distinct skin-aging pathway linked to particulate matter (PM). Polycyclic aromatic hydrocarbons (PAHs) bound to the surface of PM have the ability to penetrate the skin and directly adulterate skin cells, causing the formation of wrinkles and dark spots, or triggering inflammation. Symrise has identified a molecule, benzylidene dimethoxydimethylindanone, capable of neutralising their disruptive effects. Trade named SymUrban, it significantly reduces the expression of MMP-1, which is primarily responsible for the formation of wrinkles and sagging skin. SymUrban also inhibits melanin synthesis and inhibits the pollution-induced expression of inflammation gene markers such as Interleukin-6 (IL-6), which is linked to an inflammatory response of the skin or inflammaging.

EcoPhysalis from **Chemyunion** is an aqueous/glycolic extract of Physalis angulata claimed to activate the natural anti-oxidant defence system of the skin after sun stress. It reduces skin discomfort and sensitivity after exposure to the sun and inhibits melanin synthesis, helping skin tone luminosity and uniformity. It also normalises superoxide dismutase (SOD) and catalase activity after sun stress. Phytescence Speedwell from **Crodarom** is an aqueous extract of Veronica officinalis that mainly comprises luteolin-7-glucoside and iridoids glycosides with antioxidant, radical scavenging and soothing properties. Tests show that it improves cell cohesion and protects the integrity of the epidermal barrier. They also demonstrate a decrease in IL-6 release under UVB stress and to support a reduction in discomfort and inflammatory response.

Described as a biomimetic active and natural skin defence booster, Dragosine from **Symrise** is a nature-identical peptide (carnosine) that provides infra-red protection and has antiglycation and anti-oxidant properties and supports skin firmness and elasticity by inhibiting the formation of cross-linked proteins. Also from Symrise, SynFinity 1298 is an extract of Echinacea purpurea and is described as an advanced concentrate against inflammaging. It increases the basal SIRT1 protein level of the epidermis so that wrinkling is reduced and it exhibits an anti-redness activity on skin exposed to UVB radiation, thus reducing inflammaging.

Reasun from **Solabia** is an extract of Curcuma longa (turmeric) root obtained via the hydroglycolic extraction of Oceania saffron rhizomes found in French Polynesia. Traditionally an ointment was made by marinating the root in scented coconut oil and used to soothe pain. Solabia laboratories identified the presence of curcuminoid compounds similar to polyphenols and studies carried out on

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these curcuminoids have highlighted their anti-oxidising properties and their soothing action. It also imparts a protective effect on Langerhans cells exposed to solar radiation and shows a small but significant gain in SPF when added to a sun cream. Solabia provides supporting data that shows its antioxidant effect on β -carotene and against OH radicals, its enhancement of SPF and its protective effect on Langerhans cells.

Solabia also markets Celloxyl [INCI: Propanediol, Uapaca bojeri leaf extract], which is an extract from tapia leaves that contain a polyphenol called hyperoside. This has antioxidant properties to help protect epidermal stem cells against UV aggression and protect fibroblasts against mitochondrial and membrane oxidation. Other materials of interest as skin care actives in post-sun exposure compositions from Solabia include DermaPep A440 and Redyless. DermaPep A440 [INCI: Myristoyl tetrapeptide-34, butylene glycol] is described as an innovative anti-ageing tetrapeptide that inhibits expression of matrix degrading MMPs to restore collagen levels back to normal. Redyless [INCI: Propanediol, aqua, piperonyl glucoside] helps stop facial flushing and chronic redness caused by sudden changes in temperature; by consumption of alcohol and spicy food; by emotional stress and by pollution and sun exposure.

Stress, whether environmental through sun, wind and air pollution, or emotional through fatigue, diet and lack of sleep, appears to be an unavoidable part of modern life. One effect of this is that skin also becomes fatigued and disruptive sleep patterns inhibit normal cell rejuvenation. Algaktiv Zen from **Grenaltech** is described as a blend of microalgal synergistic molecules that restore the homeostasis of the skin by protecting it from inner stress signals and by restoring its natural circadian rhythm. It inhibits the expression of cortisol that leads to neural inflammation and maintains a balanced skin homeostasis to prevent premature lifestyle aging. Another material in the Algaktiv range is GenoFix UVD, which is a purified concentrate from *Auxenochlorella protothecoides* that reduces inflammation and prevents aging by significantly decreasing pro-inflammatory cytokines IL-8 and CXCL-1. It is also claimed to accelerate DNA repair, which is also the claim made for Algaktiv GenoFix CPD. This is photolyase enzyme concentrate from *Aspergillus nidulans* that accelerates the skin's natural repair mechanism in response to visible and UV light and it inhibits expression of pro-inflammatory cytokine IL-6, induced by UV radiation.

Secondary metabolites are natural products that often have an ecological role in regulating the interactions between plants and their environment. Their importance in medicine, agriculture and industry has led to numerous studies on the synthesis, biosynthesis and biological activity of these substances and it has been estimated that over 40% of medicines have their origins in these active natural products [Ref 4]. Many of the skin care actives mentioned here have been developed from plants used in traditional medicine. An example is *Centella asiatica*, also known as Gotu kola or Indian pennywort, it is traditionally used in Ayurvedic medicine for its wound healing, antioxidant and anti-inflammatory properties. It is rich in centellosides and peptides and **Vytrus Biotech** has extracted *Centella asiatica* to provide Centella Reversa. Building on the wound healing properties of *Centella asiatica* it is claimed to regenerate and proliferate skin cells and to repair and protect DNA and to improve skin firmness and elasticity.

Kalinat DNA from **Kalichem Italia** is a new, biologically active, functional ingredient. It is native deoxyribonucleic acid, that has been purified, depolymerised and neutralised with sodium ions. Several clinical tests, aimed to study its effects in the treatment of distinct types of lesions and cutaneous pathology, are evidence of the efficacy of nucleotide DNA fragments in delaying the formation and appearance of wrinkles and in the reduction of all skin phenomena associated with aging. The repairing action is linked to activation of the Immune system and stimulation of cytokines

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and growth factors synthesis. It leads to an increase of protein synthesis in cells under stress to preserve their mitochondrial integrity and regulate the energy produced in the cell.

A presentation by John Lofthouse of **CLR** given at Formulate 2016 looked at the problems causing skin to age and he said that defective DNA repair mechanisms are key factors in aging as environmental aggressors are constantly challenging skin cells' DNA. ProRenew Complex CLR is a lysate of *Lactococcus lactis* obtained from a suspension of a probiotic lactic acid producing bacterium using biotechnology. It contains cytoplasm and cell wall fragments, which increase the immunocompetence of skin cells. It is said to enhance the skin's barrier system and to assist in skin renewal by promoting gentle desquamation of dead skin cells in the stratum corneum. Lofthouse also described Phytosan K from CLR, which is an extract of glycine soja (soybean) seeds said to reduce skin redness and increase tolerance to UV radiation. Tests show that it increases skin smoothness and improves its firmness and elasticity.

Pinolumin from **Mibelle Biochemistry** is a novel neurocosmetic active from the wood of Swiss stone pine that grows at very high altitudes. It contains a resveratrol-like molecule called pinosylvin that is shown to neutralise free radicals and to block pain receptors that can lead to itching, inflammation and an uneven appearance of the skin. Pinolumin [INCI: Pinus cembra wood extract, alcohol, pentylene glycol, aqua] inhibits the function of the pain receptor TRPV1 and inhibits the release of pro-inflammatory mediators. It also protects skin collagen by inhibiting the UVA-induced production of MMP-1. Overall it calms sensitive and irritated skin, visibly reduces redness and age spots and creates a more even toned skin.

Mibelle launched two new skin care actives at In-Cosmetics 2017: SensAmone P5 contains pentapeptide-59 in a soft sphere carrier system to ensure peptide stability and improve skin penetration, Pentapeptide-59 is based on a sea anemone venom protein that is known to inhibit the TRPV1 pain receptor, calming overreactive skin and reducing skin irritation. The second material was InfraGuard, a mixture of *Caesalpinia spinosa* fruit pod extract and *helianthus annuus* (sunflower) sprout extract to protect against harmful infrared (IR) radiation, In vitro studies showed that InfraGuard protects mitochondrial DNA and blocks free radical formation upon IR irradiation. It also prevents the loss of collagen by inhibiting IR-induced MMP1 expression and tests showed it significantly improved skin firmness and density.

It seems that urban pollution is being blamed for visible signs of ageing almost as much as sun exposure. PhytoVie Defense from **TRI-K Industries** is a botanical based anti-aging active clinically proven to shield the skin against damage and irritation from environmental pollutants. PhytoVie Defense [INCI: Brassica campestris/aleurites fordii oil copolymer] forms a flexible and uniform film on the skin, creating a physical barrier that significantly reduces the penetration of air pollutants into the skin. Green tea is another natural ingredient with activity against free radicals and pollutants. Scavenox GTA from **Biocogent** is an extract of green tea leaves obtained by a sonic process that facilitates the complete extraction of all cellular components and does not involve solvents. It is claimed to provide a full spectrum of biological activity including antioxidant, anti-inflammatory and selective enzyme inhibition through its high concentrations of active catechins and other polyphenols.

Inhibiting MMP expression is a common theme for skin care actives that claim to promote skin firmness and elasticity. That is because factors like UV radiation, pollution and aging increase the MMPs and elastase levels in keratinocytes and fibroblasts. These enzymes attack and digest collagen and elastin in the extracellular matrix (ECM) resulting in a loss of elasticity, support and firmness of

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the skin and wrinkle formation. MMP-1 destroys native collagen; MMP-3 participates in the activation of inactive MMPs like MMP-1 and can fully degrade skin collagen and MMP-9 destroys denatured collagen and other ECM proteins such as fibronectin, elastin and laminin. ECM-Protect from **Lucas Meyer** is a peptide that inhibits the enzymatic activity of elastase and cutaneous MMPs to defend the skin collagen and elastin network against deleterious damages caused by UV radiation, pollution, cigarette smoke and other environmental problems.

Specifically claimed to be a natural shield against inflammaging is Diam Oleoactif [INCI: Cocos nucifera oil, oak root extract, Cocos nucifera oil, Quercus suber bark extract] from **Oéos [now part of Hallstar]**. Cork oak is very rich in anti-inflammatory triterpenes and polyphenols and Cocos nucifera oil has a high content of medium chain triglycerides, allowing a perfect vectorization of the active molecules inside the skin.

From **Ichimaru Pharcos** comes a new key word in the ageing process “DAMPS” or damage associated molecular patterns. They are cell-derived substances that are transmitted from damaged cells to non-damaged cells to initiate biological reactions. Examples of DAMPS are denatured DNA and RNA released by keratinocytes on exposure to UVB. Pharcos suggests Izayoi [INCI: Rosa roxburghii fruit extract] as an active ingredient to protect skin against cytokine release and inflammatory responses caused by DAMPS.

Ref 1 <http://www.dermatology.ca/skin-hair-nails/skin/photoaging/what-is-photoaging/>

Ref 2 Overview of Skin Aging and Photoaging; Yolanda Rosi Helfrich, MD; Dana L. Sachs, MD; John J. Voorhees, MD; Dermatology Nursing. 2008;20(3):177-183.

Ref 3 Understanding how we age: insights into inflammaging; Baylis et al; BioMed Central Ltd. 2013.

Ref 4 Pentacyclic Triterpenoids from the Medicinal Herb, Centella asiatica (L.) Urban: James, J.T.; Dubery, I.A. Molecules 2009, 14, 3922-3941.

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