The exposome’s impact on Hair, Skin & aging process
Definition of exposome & how it relates to cosmetics

Deleterious effects on skin and hair

Natural solutions from the marine and plant to protect the skin and hair from these effects
What is exposome?

- The human body is constantly exposed to various exogenous and endogenous factors collectively known as the exposome.
- Defined by the American epidemiologist Christopher Wild in 2005.
The relationship between human body and the totality of exposures to which it is subjected, could complement genetic information, explaining the origins of some chronic disease and provide the basis for the development of new strategies of prevention and/or protection. Increasing attention is being paid to the exposome of human skin: as a barrier organ, skin is exposed to a huge variety of environmental factors, inducing aging acceleration. Skin aging results from the cumulative effects of chronological aging and environmental factors and is clinically and instrumentally characterized by skin dullness, dryness, laxity and wrinkles formation. From a histological point of view, skin aging is mainly characterized by epidermal thinning, Dermal-Epidermal Junction (DEJ) flattening, basement membrane delamination and alteration of the superficial dermis. Mirroring the cutaneous responses to environmental stress (Valacchi et al., 2012), the major environmental factors that contribute to premature skin aging have been recently regrouped in the so-called “skin aging exposome” which includes (i) sun radiations, i.e. ultraviolet, visible light and infrared wavelengths, (ii) air pollution, (iii) tobacco smoke, (iv) nutrition, and (v) other factors such as temperature, stress and lack of sleep that can alter skin conditions. More precisely, the external exposome encompasses exposures to specific external environmental factors (namely chemical, biological, occupational, and physical exposures, including diet, drug, and consumer products), as well as nonspecific general exposures (e.g. climate, biodiversity, and socioeconomic factors) (Figure 1).

The internal exposome includes internal chemical environments determined by internal processes (e.g. metabolic and inflammatory), as assessed through evaluation of proteins, lipid mediators, xenobiotics, and their metabolites through ad hoc omics tools. The internal exposome is specific to each subject because it depends on age, physiology, body morphology, health status, and the genome among others. There is also evidence that various environmental factors can influence the epigenome thus promoting changes in a chromosome that affect gene activity and expression, and thus modifying the risk of allergic diseases. Moreover, it is widely accepted that both host microbiome and external microbial exposure...
EXPOSOME
HOW DOES EXPOSOME IMPACT SKIN?

NUTRITION
- Facial wrinkling

SMOKE
- Photoaging
- Hyper pigmentation
- Sunburning

UV
- Thermal skin aging
- MMP upregulation

TEMPERATURE
- Decreases barrier function
- Spots and redness

POLLUTION
- Pigment spots
- Wrinkle formation
- Dull complexion

STRESS
- Scars and redness

COSMETICS

PREMATURE SKIN AGING

SENSITIVE SKIN

ATOPIC DERMATITIS, ACNE

Krutmann et al. (2017)
BIOLOGICAL EFFECTS OF EXPOSOME ON SKIN

REACTIVE OXYGEN SPECIES (ROS)

Oxidative stress

Inflammation

Epigenetic modifications

DNA, protein, lipid damages, DNA mutations, telomere shortening

AGING, DISEASES: CANCER, DIABETES, NEURODEGENERATIVE DISEASES
MOLECULAR MECHANISMS FOR EXPOSOME-INDUCED ROS GENERATION & PRO-INFLAMMATORY CYTOKINES
EXPOSOME ACTIVATES ARYL HYDROCARBON RECEPTOR (AhR) A CHEMICAL SENSOR
EXPOSOME MODULATES ENDOGENIC CELLS DEFENCES AGAINST ROS

PM

Plasma membrane

Cellular damages

ROS

Target genes:
- Phase II detoxifying enzyme
- Antioxidative enzyme
- Hemeoxygenase
- Glutathione peroxidase
- NADPH quinine oxidoreductase 1 (NQO-1)

Nrf2 activation

Nrf2 stabilisation

Keap1

Keap1

Nrf2

Nrf2 proteasome degradation

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An increasing exposure to exposome factors represents one of the major hazards affecting human health by skin diseases. The process of malignant transformation in the skin is associated with DNA damage, which causes mutations when left unrepaired. Genetic defects in oncogenes and tumor suppressors provoke disturbance of the cell cycle control and proliferation, which further leads to the uncontrolled expansion of altered cells. Protection from the deleterious alterations relies on the elimination of damaged cells via UV-induced apoptosis. Both processes, cell cycle control and apoptosis, represent a cellular DNA damage response converging on the tumor suppressor p53. As a result of chronic irradiation, excessive cell death may lead to permanent tissue damage. Thus, in order to maintain the integrity of the skin barrier, exposome responses additionally include mechanisms by which cells can survive under stress conditions. Among these, AKT/mTOR signaling reciprocally interacting with p53 emerges as a potential life/death regulator of irradiated skin cells (Figure 3). Upon activation by exposome, AKT/mTOR not only inhibits apoptosis, but also forces cell cycle transition and counteracts stress-induced autophagy. Consequently, unbalanced AKT/mTOR signaling may eventually lead to hyper-proliferation and contribute to malignant transformation. Altogether, exposome-induced modifications in the activity of signaling factors involved in anti- and pro-survival pathways may significantly alter cellular stress responses that interfere with UV-induced cell death. As a consequence, the balance is shifted from cell death to malignant transformation and to clonal expansion of UV-damaged cells.
Exposome is responsible for different skin disorders such as premature skin aging, sensitive skin, atopic dermatitis.
FIGHTS DISCOMFORT AND ITCHING INDUCED BY EXPOSOME

- Has an immediate soothing effect
- Decreases erythrosis
- Reduces heating and flushes sensations
- Prevents premature aging induced by exposome
- Maintains bacterial diversity and fights against species involved in redness

Inci Name: Glycerine, Water, Hydrolyzed Rhodophycea extract
Protects against global pollution attacks
Fights free radicals damages
Activates endogenous skin defenses & cellular detoxification system
Prevents inflammation
Strengthens cutaneous barrier & maintains dermis integrity
Improves skin hydration & radiance

Inci Name: Aqua(Water), Propanediol, Schisandra chinensis fruit extract
- Reduces free radicals & protects skin barrier integrity
- Limits acute and chronic inflammation
- Inhibits hyperpigmentation
- Prevents extracellular matrix degradation

Inci Name: Buddleja Officinalis Flower Extract
EXPOSOME ON SKIN

EXPOSOME ON SKIN
- Oxidative stress and inflammation
- Dehydration and matrix degradation
- Dysbiosis

THE MAIN SOLUTION IS A SYSTEMIC ACTION
- To act on Nrf-2 and DJ-1 pathways
- To preserve barrier and tight junction proteins
- To rebalance skin microbiota
WHAT ABOUT SCALP & HAIR FACE TO EXPOSOME?
Skin is mostly impacted by exposome. Skin is the interface between us and the environment and acts as a real barrier.

Hair is mostly impacted by exposome.
THE HAIR IS THE RICHEST ORNAMENT OF WOMEN
(M. Luther: 1843-1546)

Cultural identity
Social class
Marital status

Religion
Age
Gender
HAIR DAMAGES

- **Heat damage**
- **Hairdye/bleaching**
- **Sun damage**
- **Mechanical stress**

Healthy hair

(Extremely) damaged hair

Damaged hair tip

Hair damage => Decrease of shine, smoothness, resistance, combability.
**EXPOSOME & HAIR**

**Keratin**: sulfur-rich protein. Cysteines form disulfide bonds for a resistant hair structure and optimal hair quality.

**Lipid layer** (Long chain fatty acids 40% of 18-MEA* (C21))

**Cuticle** (6-8 layers) over lapping cells like scales

**LIPID PEROXIDATION DEGRADATION**

**PHOTODEGRADATION OXIDATION**

**BREAKAGE OF DISULFIDE BONDS**

**PROTEIN DEGRADATION** (CARBONYLATION)

**CUTICLE PEEL OFF:**

⇒ LOSS OF CORTEX PROTECTION
⇒ LOSS OF COMBABILITY & DETANGLING
⇒ LOSS OF SHINING

* 18-methyleicosanoic acid
CONSEQUENCES OF EXPOSOME ON HAIR

HAIR GRAYING

UV & POLLUTION HAIR DAMAGED

ALOPECIA
SOLUTIONS FOR HAIR
> PENETRATION at the heart of hair

> PROTECTION against protein oxidation
  > PROTECTION of keratin structure
  > MAINTAINS Tryptophan and Cystine in fiber

> PRESERVATION OF HAIR STRUCTURE INTEGRITY

> IMPROVEMENT OF HAIR STRENGTH & HAIR SHINE

ANTI-UV & POLLUTION
HAIR DAILY PROTECTOR
• Reduces oxidative stress in hair follicle cells

• Increases antioxidant genes expression in melanocytes

• Increases melanin synthesis
LINK BETWEEN EXPOSOME & SCALP MICROBIOTA?
Slows hair-loss

Gives hair vitality and density

Extends the hair growth cycle
LIFE ON THE SCALP HAIR
THIS IS MICROBIOTA

- Actinobacteria, Firmicutes and Proteobacteria
- Propionibacterium, Staphylococcus and Corynebacterium
- Cutibacterium spp. and Staphylococcus spp. and Malassezia spp. colonize the healthy scalp

Inflammatory responses associated with Cutibacterium and Malassezia fungus and scalp diseases (dandruff, seborrhea, dermatitis).

> Role of BACTERIOBIOTA & MYCOBIOTA in Androgenic Alopecia?

Polak-Witha et al., 2019
1 CHARACTERIZATION OF ALOPECIC SCALP MICROBIOTA

BACTERIOTA
- Stenotrophomonas geniculata ↑
- Cutibacterium acnes/ Staphylococcus epidermidis ratio ↑

MYCOBIOTA
- Malassezia globosa/Malassezia restricta ratio ↓

2 EFFECT ON SCALP MICROBIOTA

REBALANCES SCALP MICROBIOTA LINKED TO A HEALTHY SCALP
1/ REBALANCES
BACTERIOBIOTA & MYCOBIOTA ENVIRONMENT

2/ ACTS ON
MAIN CELLULAR PATHWAYS LIMITING HAIR LOSS

3/ MORE EFFICIENT THAN MINOXIDIL

BACTERIOBIOTA
C.acnes & S.epidermidis

MYCOBIOTA

BIOLOGICAL MARKERS OF HAIR LOSS
EXPOSOME ON HAIR

EXPOSOME ON SCALP & HAIR
- Damaged hair & peel off
- Graying, dehydration & hair-loss
- Dysbiosis

MAIN NATURAL SOLUTIONS
- Biomimetic lipid layer
- Strengthens intrinsic defenses system
- Rebalance scalp microbiota
You are more than your genes.
Thank you
For your attention