ZOOM

The Magazine Dedicated to Global Cosmetics Evaluation

IN-VIVO STUDIES

Exposome
Biomarkers
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BEAUTY TESTING TRENDS

Market barometers
Paris - New York
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IN-VITRO ASSAYS

Extracellular matrix
Top claims
Testing advances

Anti-pollution evaluation

by skinobs

EDITO

Dear readers,

Welcome to the Spring edition of ZOOM. We've been talking about testing with you for 10 years now, and we're still just as delighted. While innovation in cosmetics and personal care is advancing faster than ever, evaluation methods are evolving just as rapidly, combining biology, physics, optics, and data science to evaluate product performance on the exposome protection. In this issue, our case study sheds light on the assessment of the skin pollution protection. In 2026, skin health is evaluated at the intersection of biological and environmental factors. Beyond simple pollution, the Exposome now integrates the skin-brain axis, microbial equilibrium.... Through AI and advanced imaging, science now objectifies the invisible: cutaneous hypoxia, mechanical decline, and dysbiosis. This holistic and inclusive approach redefines protection as «longevity capital,» transforming every treatment into a scientifically proven shield against urban stressors.

Beyond clinical assessment, to meet the demand for science-based cosmetics, the industry is shifting toward highly predictive in vitro methodologies. Moving beyond traditional 2D cultures, researchers now utilize sophisticated innervated 3D models and microfluidic platforms to simulate exposome-induced stress. These tools evaluate barrier integrity and neurogenic inflammation through multi-parametric biomarkers, from DNA damage to mitochondrial proteins, providing high-resolution evidence for ingredients designed to shield against physical and chemical environmental triggers.

This issue also features a keynote from the recent SFC International Symposium, where innovations in skin assessment took center stage. The symposium revealed a shift toward holistic health, merging AI with high-tech analytical methods like proteomics to decode the dialogue between skin layers and beauty routines. We explore this further through the rapidly expanding field of skin microbiome assessment, where cutting-edge techniques like metagenomics and metabolomics reveal how microbial communities interact with the skin barrier to influence overall health.

The latest Skinobs barometers show a multi-polarization of the testing cosmetic science is multipolar: Europe leads in molecular rigor and «Deep Science,» North America prioritizes inclusivity and validated user experience, while Asia drives growth through AI-driven digitalization and specialized performance, creating a fragmented yet technologically synergistic global evaluation market.

Finally, what are the major claims shaping the future of cosmetic testing? You will discover the top ranking of preclinical and clinical categories from the statistics of the testing database coming from the audience of the 9000 + users from 124 countries in 2025.

At Skinobs, we believe that understanding these trends is essential for anyone shaping tomorrow's beauty innovations. Whether you are a formulator, researcher, or evaluator, our goal remains constant: to provide a clear, documented, and scientifically robust vision of testing evolution. Our mission remains unchanged: to inform you about the latest advances, connect you with the most relevant experts, and help you choose the assessment solutions best suited to your ambitions. This issue of ZOOM is designed to fuel your thinking and inspire you in the development of your future products.

We hope this ZOOM will inspire you to look deeper into what defines beauty evaluation, not only in appearance but in measurable, scientifically validated skin health.

Enjoy the magazine!

Warm regards,

The Skinobs Team

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What's inside

CLINICAL STUDIES

The Skin Exposome: Current Trends and Clinical Evaluation Challenges

In the scientific landscape of 2026, the cosmetic industry has reached a definitive consensus: skin health is no longer a localized phenomenon but a complex intersection of environmental, physiological, and psychological factors. This holistic framework, centered on the **Exposome**, has fundamentally transformed clinical evaluation. We have moved beyond measuring simple protection against pollutants to a deeper understanding of how the skin-brain axis, microbial equilibrium, and climatic variables dictate cutaneous resilience and aging. The biological and environmental determinants of skin appearance are influenced by both intrinsic factors (genetics, skin structure, pigmentation patterns, vascularization) and extrinsic factors including sun exposure, pollution, nutrition, stress, and lifestyle habits.

The Molecular Impact of the Urban Cocktail

Recent research has deepened our understanding of the «cocktail effect,» where the synergy between Particulate Matter (PM), Ozone (O3), and Full-Spectrum radiation (UV, Blue Light, and Infrared) creates a far more aggressive oxidative profile than isolated pollutants. This interaction triggers the activation of the **Aryl Hydrocarbon Receptor** (AhR), a key biological sensor that, when overstimulated, leads to the upregulation of cytochrome P450 enzymes and the subsequent release of **pro-inflammatory cytokines.**

The clinical consequences of this molecular cascade are now precisely mapped across two distinct timelines:
• **Short-term effects**: These manifest as an immediate increase in toxins, barrier function disorders, and a **decrease in skin resistance to UV**. Clinically, we observe shifts in pH, protein and lipid oxidation, DNA oxidation, and pore occlusions. Physiologically, this often results in a **lower rate of hydration and an increase in sebum production**.
• **Long-term effects:** Cumulative exposure leads to structural degradation, including the breakdown of collagen and elastin through matrix metalloproteinase (MMP) activity. The visible results are **wrinkles, sagging, persistent age spots, acne, sagging, and chronic sensitivity.**

Associated Claims: Bridging Science and Marketing

For brands in 2026, «anti-pollution» has evolved into a sophisticated hierarchy of claims designed to resonate with urban consumers. These claims are backed by rigorous curative and preventive testing:
• **Skin Detox & Purification:** Claims like «Cleansing,» «Purifying,» or «Oxygenizing» target the removal of toxins and the restoration of cellular respiration.
• **Rebalancing & Repair:** These focus on «Soothing,» «Nourishing,» and «Sebo-regulation.» They aim to restore the complexion and microcirculation while fighting the «sagging» induced by environmental stress.
• **Full-Spectrum Protection:** The preventive pillar includes claims such as «Anti-Free Radical,» «Anti-Blue Light,» «Barrier Integrity,» "Glow & radiance" and «Anti-Spot.»

Today, one of the most powerful marketing drivers is **Skin Radiance.**

For brands, «anti-pollution» has evolved into a hierarchy of claims designed to resonate with urban consumers.

Pollution is now clinically recognized as a «glow-killer" particulate matter and carbon monoxide don't just sit on the surface; they induce a state of **«cutaneous hypoxia»** by reducing the skin's oxygenation levels. This leads to a **slowdown in cellular turnover, causing an accumulation of dead, oxidized cells** that scatter light instead of reflecting it. Consequently, the skin appears dull, sallow (yellowness), and physically rough. Depending of skin type, skin radiance is governed by complex optical interactions, absorption, scattering, and reflection, within cutaneous structures. Dermal-epidermal parameters, including collagen organization, melanin distribution, and surface topography, dictate light behavior. Pathological or physiological alterations, such as uneven pigmentation or structural roughness, impair homogeneity, thereby diminishing perceived luminosity and inducing a dull complexion.

To substantiate claims like **«Urban Glow Recovery» or «Anti-Dullness Shield,»** laboratories now use a combination of optical and colorimetric measurements:
• **Skin color by chromametry:** The measure is easy, fast, reproducible, and well established in the cosmetics evaluation. Various instrumentations Mexameter MX 18, Colorimeter (C+K), SkinColorCatch, Chromameter, ViewSkin (Orion) and other Spectrophotometers can evaluate the color of the skin. Specifically measuring the «L» (lightness) and «b» (yellowness) values to quantify the reduction in sallow tones. The L* value is an indicator of skin brightness; however, the correlation is lowered in very bright skin tone.
• **Goniophotometry:** Using devices like the GonioLux, Glossymeter, SambaFace, Skin Transluency, SkinGlossMeter to measure the specular reflection of light, proving that the product smooths the micro-topography of the skin for a «glass-skin» effect.
• **Transcutaneous Oxygenation (TcpO2)**: A high-tech metric used to back claims of «Oxygenating» or «Detoxifying» efficacy, showing an improvement in tissue vitality.

Clinical Methodologies: Standardized vs. In-Situ

To validate these multifaceted claims, two major testing approaches are utilized to substantiate **the anti-pollution effect of Beauty routine:**
1. **Standardized Polluted Environments:** Using «Pollution Boxes» (developed by labs like CIDP, Complife, Ellead…, researchers recreate controlled conditions using UV, ozone, cigarette smoke, and particles. The precision in measuring these pollutants is key to the reproducibility of the results.
2. **In-Situ Urban Testing:** Reserved for human testing, this model evaluates products in the «real world» of polluted cities, offering high consumer relevance by accounting for daily variations in humidity and atmospheric «smog.»

The 2026 Analytical Toolkit: Quantifying the Invisible

Modern evaluation relies on sophisticated sampling and visualization. Before chemical analysis, samples are collected via **stripping, swabbing, scrubbing, or glass sticks.** The analysis then follows specific pathways:
• **Protection Performance**: visualization

of PM deposits and heavy metal analysis (Lead, Iron, Chromium)
• **Antioxidant Efficacy:** measuring lipidic peroxidation (SQ-OOH, MDA) and protein carbonylation.
• **Detoxifying & Oxygenation**: measuring the transcutaneous partial pressure of oxygen
• **Complexion & Radiance**: utilizing high-end imaging like to measure the «glass-skin» effect and uniformity.
• **Structure & Visualization**: using LC-OCT, Multiphotonic, and Confocal Microscopy to quantify dermal changes and the integrity of the extracellular matrix.

Neurosensory Pathways and the Skin-Brain Axis

A major advancement in 2026 is the clinical integration of **the skin-brain axis** within the exposome framework. Scientific evidence now confirms that environmental stressors do not only cause physical damage but also activate neurosensory pathways that exacerbate **skin sensitivity.** Stress, both psychological and physiological, modulates the **release of neuromediators** that can weaken the skin barrier and increase cutaneous reactivity.

This has led to the emergence of «Neuro-cosmetic» testing. The scientific objectification of emotions relies on a holistic approach combining three fundamental pillars. The **expressive component** analyzes behavioral manifestations (facial, postural, vocal), while the **physiological component** measures variations in the autonomic nervous system via imaging or biometrology. Finally, the **cognitive component** apprehends the verbalizable subjective experience. To guarantee the reliability of the analyses, the design of protocols must imperatively conjugate these complementary methods according to the claim, the product, and the consumer profile.

Clinicians now use real-time monitoring of cortisol levels and heart rate variability

ANTI-POLLUTION ON SKINOBS TESTING PLATFORM

| 45 testing methods | 130 CRO's in 35 countries | 32 study parameters |

alongside traditional metrics like hydration…By utilizing video-based AI analytics to track micro-expressions and sensory responses, CROs can quantify the **soothing effect** of a formula on a neurological level, offering a holistic validation of several claims.

Microbiome Equilibrium as a Shield of Resilience

The role of the skin microbiome has become a cornerstone of clinical resilience studies. Research indicates that a **healthy microbial ecosystem** acts as a living shield, metabolizing certain pollutants before they can penetrate the epidermis. However, prolonged exposure to urban pollution and UV radiation can lead to dysbiosis, favoring the **growth of pathogenic species** and accelerating conditions such as **acne and sensitive skin syndromes.**

Today, the gold standard for anti-pollution testing includes high-throughput sequencing to assess **microbial diversity.** Clinical trials now aim to prove that a product actively maintains the skin's ecological balance. This «Microbiome-Positive» approach provides a measurable parameter for assessing a product's ability to reinforce the skin's natural defenses against the modern exposome, moving the industry toward a more regenerative model of skincare.

In vivo human testing gives a broader view of the microbiome, analysing microbes within their natural context and allowing longitudinal analysis. As the important intra-individual diversity of the cutaneous flora is also associated with a high level of inter-individual variability, study population and study design are of extreme importance. Sample collection methodologies include swabbing, tape stripping, scrubbing, biopsies and now a days companies are even proposing self-sampling at-home collection kits. The integration of multiple layers of biological analysis, including **genomics, metabolomics and proteomics** also known as multi-omics, provide a more comprehensive understanding of how products impact both the human body and its microbiome. To do so, the exploitation of metadata to perform bioinformatic/biostatistics analysis to

delineate potential cause/association with sequencing results of great importance.

The Convergence of AI and Full-Spectrum Protection

The integration of Artificial Intelligence and advanced imaging has fundamentally transformed the speed and precision of clinical evaluation. The use of **In Silico modeling** and «Digital Twins» virtual representations of various skin phototype allows researchers to predict the safety and efficacy of complex ingredient combinations.

Furthermore, the scope of photoprotection has expanded to «Full-Spectrum» defense. Modern testing protocols must address the cumulative impact of the **entire light spectrum**, including high-energy visible (HEV) light and near-infrared (IRA) radiation. Advanced diagnostic tools like Line-field Confocal Optical Coherence Tomography (LC-OCT) and Raman spectroscopy allow for non-invasive, real-time visualization of these impacts, providing objective data on how a product preserves the skin structure across different climatic conditions.

As we navigate 2026, the clinical evaluation of anti-pollution claims has evolved from a technical requirement into a central strategic pillar of product development. The transition from «Anti-Pollution» to «Exposome Resilience» reflects a deeper, more holistic understanding of skin biology where environmental protection, microbiome balance, and neurosensory well-being converge. It is essential for investigators to collaborate closely with CROs to meticulously design protocols, define inclusion criteria, establish measurement timelines, treatment conditions, and

select optimal devices. Investing time in briefing these essential elements is never wasted; it ensures the integrity and reliability of the study outcomes.

In an era of «skintellectual» consumers and stringent regulatory scrutiny, marketing narratives are no longer sufficient; they must be anchored in «Science you can see.» By leveraging high-tech diagnostic tools, from LC-OCT imaging to AI-driven radiance analysis, cosmetics brands can now provide transparent, quantifiable evidence that builds long-term consumer trust.

Ultimately, mastering the skin exposome is not just about shielding the surface; it is about preserving the skin's biological capital and ensuring its **long-term health in an ever-changing environment.** For the modern formulator and the regulatory manager, success lies in this perfect synergy between cutting-edge objectification and the promise of visible, verifiable results.

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The Hair and Scalp Exposome: The New Frontier

The hair and scalp are now recognized as critical bio-indicators within the exposome framework, often showing the first signs of environmental fatigue long before the facial skin. Because the scalp is significantly **more permeable** and possesses a much **higher density of sebaceous glands** than facial skin, it acts as a literal magnet for heavy metals, carbon particles, and secondary pollutants. This leads to a state of «Scalp Hypoxia» and chronic micro-inflammation that compromises the follicular environment. Research in 2026 shows that these pollutants do not merely reside on the surface but induce oxidative stress within the hair follicle itself, compromising keratin synthesis and leading to premature thinning, structural brittleness, and lipid depletion. Clinical evaluation now employs high-resolution scanning electron microscopy to visualize particle adhesion on the cuticle and sophisticated tensile strength testing to quantify the protective film-forming properties of new formulations. By **treating the scalp as an extension of the skin's ecosystem**, the industry is moving toward «Scalp Shield» technologies that preserve both the microbial balance of the cranial skin and the long-term structural integrity of the hair fiber.


Gen Z and the Digital Exposome: From Correction to Longevity

For the Gen Z cohort, the exposome is not merely an external threat but a lifelong accumulation of biological stressors that must be actively managed through early and continuous intervention. This generation has fundamentally shifted the clinical focus away from traditional anti-aging toward «prejuvenation» and «skin-longevity,» where the ultimate goal is to maintain the skin's native biological capital. Clinical evaluation for this demographic now centers heavily on the impact of the digital environment, specifically the chronic exposure to High-Energy Visible (HEV) light and its disruption of circadian rhythms. Modern protocols for Gen Z utilize wearable biosensors to track real-time environmental exposure alongside at-home microbiome sampling kits. This allows researchers to correlate urban pollution levels with immediate shifts in skin barrier function, moving toward a personalized model of «stress-proof» skincare that addresses the skin-brain axis and the psychological toll of a hyper-connected lifestyle.

## Universal Resilience: Adaptive Clinical Testing for Global Skin Diversity

The evolution of exposome research in 2026 has definitively moved toward a comprehensive methodology that embraces the full spectrum of human skin. Scientific consensus now acknowledges that environmental stressors like ozone and particulate matter interact uniquely with **different skin phototypes**, particularly regarding melanin distribution and inflammatory pathways. In darker skin tones (Phototypes IV-VI), the urban cocktail acts as a primary trigger for **post-inflammatory hyperpigmentation** and chronic dullness, where pollutants act as catalysts for melanocyte overactivity. Conversely, in lighter phototypes, the same stressors primarily accelerate collagen degradation and visible redness through intensified matrix metalloproteinase activity. To address these variations, clinical trials have expanded into global urban hubs to capture the **physiological reality of diverse populations in high-smog environments.** Modern instrumentation, such as multi-spectral spectrophotometry and LC-OCT, is now precisely calibrated to provide unbiased data across the entire Fitzpatrick scale. This ensures that «urban glow» and «anti-spot» claims are biologically verified and effective for every consumer, providing a standardized level of efficacy regardless of ethnic background or geographic location.

CASE STUDY
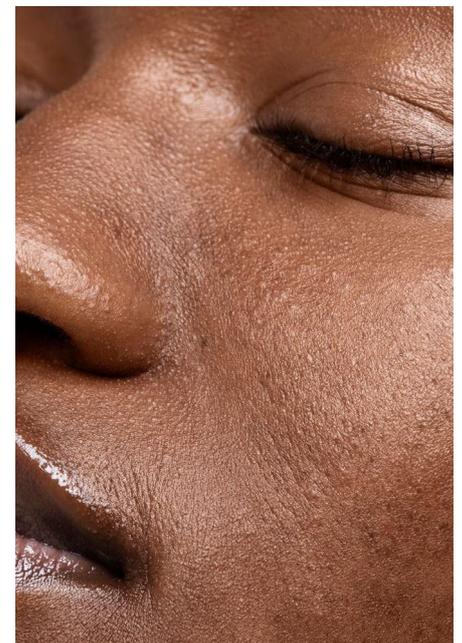
PRECLINICAL ASSAYS

Advanced in-vitro assays to understand the exposome impact on the skin

One of the primary drivers of the Sensitive Skin Syndrome (SSS) is the Exposome, a comprehensive term encompassing all exogenous factors and individual encounters throughout their lifespan. Physical stressors like ultraviolet (UV) radiation, temperature fluctuations, and mechanical friction, alongside chemical stressors such as pollutants, water quality, and cosmetic formulations, act as potent triggers. As cosmetics brands need science-based products, the industry faces an imperative need to develop highly predictive in vitro assays to evaluate ingredients and finished products performance on the exposome protection. This article explores the current landscape of in vitro methodologies, moving from traditional 2D cell systems to sophisticated, innervated 3D models and microfluidic platforms, with a focus on barrier integrity and neurogenic inflammation.

There are various methods which enable to evaluate anti-pollutant efficacy on cell supports, skin model or skin 3Dprint using many biomarker analyses: Cell Proliferation, Lipid metabolism, Carbonylated proteins, Antioxidant defenses markers, DNA damage, various Proteins (barrier function, pigmentation or mitochondrial), Inflammation mediators, or Protease activity.
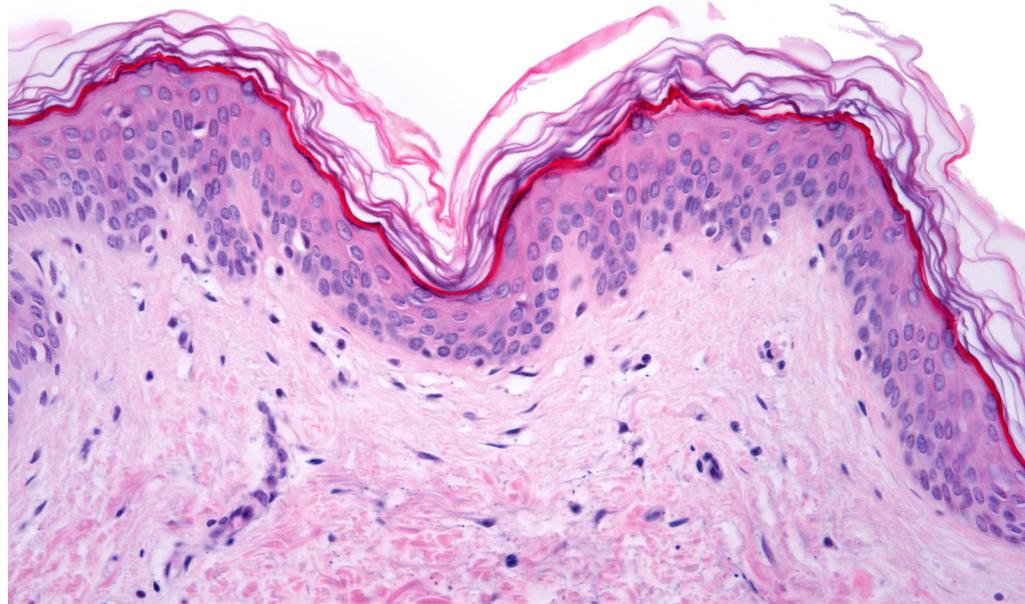
Technological advances in in-vitro assays

The evolution of in vitro testing has moved toward increasing physiological complexity to better reflect the in-vivo environment. While 2D cell cultures and co-cultures remain cost-effective for initial screenings, they cannot replicate the 3D cellular architecture or the complex barrier function of human skin. Consequently, **3D reconstructed human epidermis (RHE)** and **fullthickness Skin model** have become the standard for 3D skin models. These models, whether bioprinted or manually reconstructed, can be vascularized, augmented with neurons cells or capillaries. They also can be specifically designed from aged skin and specific skin types and allow for a more accurate assessment of barrier integrity and pharmacological penetration. The emergence of **Skin-on-a-Chip** technology offers promising prospects for exposome research. These **microfluidic models** closely reproduce physiological conditions, such as cytokine gradients and spatially organized cellular interactions. They provide a dynamic environment that mimics the flow of interstitial fluids, offering a more robust platform for screening ingredients against complex urban pollution or fluctuating environmental conditions.

The Physiological Triad of Sensitive Skin Evaluation

To design effective therapeutic or cosmetic solutions, one must understand the three interrelated mechanisms governing the Sensitive Skin Syndrome: **barrier function disruption, immune activation, and neurogenic inflammation.**

The skin barrier, whose function is directly related to the Stratum corneum integrity, serves as the body's first line of defense. Utilizing the «brick and mortar» model, the SC consists of corneocytes (the «bricks») ultra-differentiated, metabolically inactive keratinocytes, embedded in a lipid-rich intercellular matrix (the «mortar»). When this barrier is damaged by external stressors, the penetration of irritants and pathogens increases, fueling the phenomena of inflammation (inflammaging).

In the presence of stressors, resident skin cells, keratinocytes, fibroblasts, and dendritic cells, initiate an **inflammatory cascade**. This involves the release of **key mediators** such as IL-1α/β, IL-6, TNF-α, and IFN-γ. In more specific allergic or pruritic reactions, the Th2/Th17 axis is activated, with the release of cytokines like IL-4, IL-13, IL-17, and IL-31. This immune activation is a crucial step in the transition from localized irritation to systemic sensitivity.

CASE STUDY

Neurogenic Inflammation: The Nervous System's Role

A distinguishing feature of the Sensitive Skin Syndrome is the involvement of the peripheral nervous system. Sensory nerve fibers respond to mechanical, thermal, or chemical stimulus by releasing neuropeptides, such as **Substance P (SP), Calcitonin Gene-Related Peptide (CGRP), and Neurokinin A**. These mediators act directly on skin cells and immune cells (mast cells), amplifying the inflammatory response. Furthermore, SSS is often associated with small-fiber neuropathies involving receptors like **TRPV1** (Transient Receptor Potential Vanilloid 1), which mediate the perception of heat, acidic pH, and chemical irritants like capsaicin or histamine. By incorporating **sensory neurons** derived from induced Pluripotent Stem Cells (iPSCs) in cells co-cultures, researchers can now investigate the neuronal contribution to inflammation with **innervated models.** These innervated models provide a unique opportunity to study how sensory neurons release neuropeptides under stimulation, driving inflammation and discomfort, and how active ingredients may modulate these pathways.

The Extracellular Matrix (ECM) a key element of the pollution protection

The skin's ability to withstand the exposome is also dependent on the dermis and the conditions of the extracellular matrix. The skin behaves as a viscoelastic material, a property primarily conferred by the dermis. The ECM of the skin is a complex, 3D network that provides structural support, regulates cell behavior, and maintains hydration. It is divided in 2 compartments:

1. Fibrous Proteins « The Scaffold »
• **Collagens (70-80%):** Provide tensile strength. They include fibril-forming (Types I (~80%), II, III (~15%), network-forming (Type IV), and fibril-associated types.
• **Elastin (2-4%):** Forms a network of elastic fibers and allows the skin to «snap back» after stretching (resilience).
2. Ground Substance, the gel-like environment that fills the space between fibers and cells (fibroblasts).
• Glycosaminoglycans (GAGs):
Polysaccharides like **hyaluronic acid** and Sulfated GAGs that maintain hydration
• **Proteoglycans (PGs)**: These are GAGs attached to a protein core: Decorin regulates the assembly of collagen fibers. Versican: bind water and provides the viscoelasticity. Lumican: Crucial for regulating collagen fibril diameter.
• **Laminins and Fibronectin:** Act as «biological glue,» facilitating cell attachment and migration.

However, chronic exposure to the urban exposome and free radicals alter this balance. Collagen fibers can become excessively cross-linked via **glycation**, leading to the formation of **Advanced Glycation End Products (AGEs),** which increase rigidity and degrade the ECM architecture.

This incredible network that represents the skin extracellular matrix is modulated by exogenous environment. The ECM can be studied in many ways through the analyse of its various components and their interactions.

A healthy skin barrier as the best protection to exposome

A healthy barrier requires a **balanced cycle of cells proliferation and differentiation**. The first line of biological defense involves antimicrobial peptides (AMPs) such as **human cathelicidin LL-37, beta-defensins, and Psoriasin (S100A7)**.

These peptides, alongside the pH and hydration status (driven by **Natural Moisturizing Factors** from filaggrin

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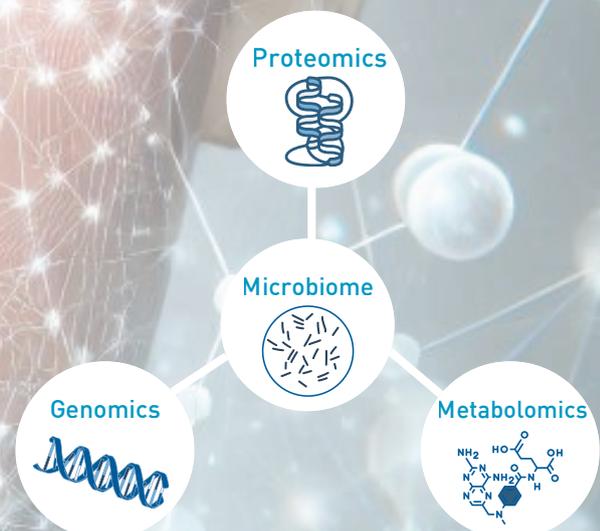| 15 study parameters | 53 CRO's in 12 countries | 11 analytical methods |
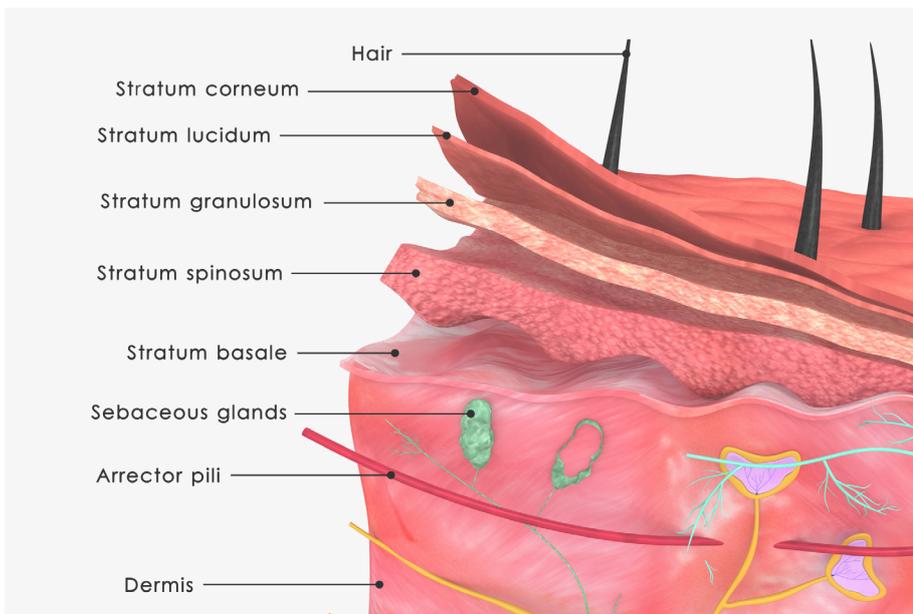
degradation), maintain the skin's biological balance.

1. Evaluation of skin barrier efficiency
Skin barrier normally prevents the passage of various molecules. Its integrity may therefore be assessed by measuring Trans Epidermal Water Loss (TEWL), Transepithelial/transendothelial electrical resistance (TEER), or the entry of various molecules through the epidermis thanks to Franz Cell (OECD 428) or other percutaneous penetration technics.

2. Skin barrier formation
Skin barrier integrity involves an appropriate formation and renewal correlated to keratinocyte proliferation, differentiation, and desquamation. Various biomarkers allow to assess the distribution of undifferentiated keratinocytes (K5, K14), their stemness (K15, K19), their proliferation (Ki67) and their state of differentiation (K1, K10, Loricrin, Involucrin, Filaggrin). Other markers such as K6, K16 (reinforce the cell-cell and cell-matrix cohesion) transglutaminases 1, 3 and 5 (control involucrin and loricrin covalent-crosslinking), Sirtuin-1 (controls filaggrin synthesis), Caspase 14 (controls filagrin degradation) or kallikreins (involved in desquamation) are also interesting. Filaggrin degradation leads to Natural Moisturizer Factor (NMF), a key factor for skin hydration. Appropriate skin hydration and pH allow the proper functioning of skin enzymes involved in stratum corneum formation and cell cohesion.

Some components of the dermal-epidermal junction (DEJ) such as Laminin 332 (Laminin V), type IV collagen, nidogen-1 & 2 and Perlecan or allowing the fixation of keratinocytes on the DEJ such as Integrin α6 and β4 are not only responsible for the adherence between dermis and epidermis but also have an impact on keratinocyte survival, stemness, proliferation and differentiation and therefore on skin barrier function.

3. Tight junctions and skin integrity
Tight junctions are responsible for the cohesion between the corneocytes and prevent the transfer of various molecules through the SC. Their integrity may be assessed with Corneodesmosin, Zonula Occludens 1 (ZO1), Occludin, E-Cadherin, Desmoglein-1, Claudin 1. SC cohesion also involves proteins such as envoplakin and periplakin which connect intracellular keratins to membrane and cellular junctions.

4.Antimicrobial peptides
The first line of defense against pathogens is formed by the antimicrobial peptides secreted on skin surface. Such antimicrobial peptides are for example human cathelicidin LL-37, types 1-4 β-defensins, psoriasin (S100A7), calprotectin (S100 A8/9), koebnerisin (S100A15) and RNase 7.

5. Stratum corneum lipid barrier
Lipid composition and organization is also highly important for skin barrier function. Epidermal thickness, SC thickness and lipid organisation may be assessed using Raman microspectroscopy while lipid composition is obtained using liquid chromatography coupled to high-resolution mass spectrometry. This may allow to evaluate in particular ceramide synthesis, subclasses, and organization.

Anti-Pollution Specific Protocols

The urban exposome induces chronic stress, leading to carbonylated proteins, DNA damage, and lipid peroxidation. Testing laboratories have developed specific protocols to substantiate anti-pollution claims.

Pollutants, such as cigarette smoke, ozone, heavy metals, volatile organic compounds (VOCs), and particulate matter (PM2.5), can be applied directly to culture media or sprayed in controlled chambers. The choice of model depends on the specific mechanism being studied, such as pollutant adhesion or removal, or the reduction of oxidative stress.

To provide robust data packages, contemporary protocols focus on several critical markers:

• **Aryl Hydrocarbon Receptor** (AhR) Activation: A primary sensor for chemical pollution. Its modulation indicates a product's ability to prevent the biological «alarm» triggered by Ozone or PAHs.
• **Protein Carbonylation** (PC): A stable indicator of long-term oxidative damage to the dermal matrix,
• **Lipid Peroxidation** (SQ-OOH / MDA): Markers of immediate oxidative stress on the surface.
• **Inflamm-aging Mediators**: IL-1\alpha and IL-8 quantify the inflammatory response and the soothing efficacy of neuro-cosmetic ingredients.
• **Filaggrin & Loricrin Expression**: to prove the reinforcement of the physical skin barrier against particle penetration.

The *in vitro* evaluation of the skin exposome represents a source of constant innovation. By combining the «three pillars» of **assay design, relevant biomarkers, advanced analytical methods** and complex assay supports, the industry can move toward a more predictive and ethical alternative to human testing. These assays can demonstrate the effects in preventing pollutants **from adhering to the skin**

surface, removing pollutants from the skin or in reducing their oxidative impact.

These advanced tools do not merely assess surface-level interactions; they provide a deep understanding of how external stressors disrupt the balance between barrier integrity, neurogenic signaling, and the biomechanical scaffold of the ECM. As the global beauty market continues to be challenged by evolving environmental stressors, these high-fidelity in vitro models remain the «gold» standard for studying the mechanism of action of protection from the exposome.

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Axol Bioscience
The urban skin exposome: studying skin dysfunctions with human iPSC-derived cell models

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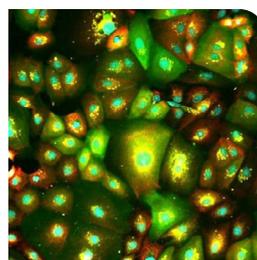
The skin is continually exposed to environmental stressors, with air pollution constituting a major component of the skin exposome. Urban pollutants contribute to acne flares, excess sebum production, pigmentation disorders, and unpleasant sensations (itching or stinging). These effects arise from **oxidative stress and inflammatory pathways** that disrupt the proper functioning of sebocytes, melanocytes, and cutaneous sensory nerve endings, amplifying skin imbalance and discomfort. **Human iPSC-derived skin models** offer a physiologically relevant way to study skin dysfunctions, enabling assessment of sebum production, pigmentation, cell viability, sensory response, and testing protective or corrective actives. **Axol Bioscience provides human iPSC-derived skin models for acne and hyperseborrhea**, active compound testing and pigmentation assays.
Contact us: operations@axolbio.com.

EXPOSOME & POLLUTION TESTING NEWS

J.S. Hamilton Poland
The impact of the exposome on scalp and hair health laboratory studies

www.hamilton.com.pl/en/

Laboratory research thrives on the dynamic interplay between controlled experimental conditions and real-world environmental exposure. In the **realm of scalp and hair health**, understanding the impact of the exposome is foundational to advancing modern cosmetic formulations. Factors such as UV radiation, environmental pollutants, thermal stress and chemical agents contribute to **oxidative stress, keratin damage, follicle dysfunction and microbiome shifts**. These effects are highly complex and vary among individuals, necessitating a customized, multiparametric approach to research. One major challenge lies in standardizing exposome factors and evaluation methods across both laboratory and clinical environments while aligning with commercial testing requirements. To tackle this, an **integrated model incorporating in vitro, ex vivo and in vivo analyses** is employed to assess cosmetic efficacy comprehensively. This approach combines precise instrumental measurements with dermatological and trichological evaluations, offering non-invasive yet thorough insights. A cosmetic product's effectiveness is validated only when it demonstrably alleviates the impacts of well-defined exposome-related factors.

Pixience
Measuring the effects of pollution on the skin with the C-Cube

www.pixience.com
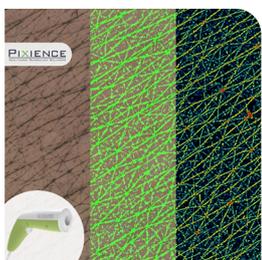
Pollution, oxidative stress: the skin exposome is at the heart of cosmetic concerns. To objectify its effects, **C-Cube Clinical Research** offers an innovative approach. Thanks to its ultra-high-resolution imaging and its colorimetric and metric calibration, the system enables to visualize and quantify particles on the skin via a pollution index. The C-Cube also makes it possible to assess the consequences of exposure to pollution: **texture irregularities** (Sa,Sq,Sdr), **pigmentation** (pigmentation index), **redness** (erythema index), **premature skin ageing** (microrelief)... The C-Cube provides you with reproducible visual and quantitative data, ideal for validating protective, anti-pollution, cleansing or detoxifying treatments.

CIDP
Evaluating exposomes: A perspective on clinical and preclinical research

www.cidp-cro.com

Environmental stressors, including air pollution and high-energy visible light, are established contributors to premature skin ageing through mechanisms involving **oxidative stress, inflammation and barrier dysfunction**. With over two decades of expertise, CIDP has developed advanced preclinical and clinical testing strategies to investigate the impact of these exposomes on skin biology. **Innovative and scientifically robust protocols** enable product evaluation under controlled conditions or simulated real-life exposure in ex vivo and in vivo models. Established methodologies allow assessment of **anti-pollution, antioxidant, protective, cleansing, and barrier-repair claims**, as well as biomarker analysis. Tailor-made protocols support cosmetic brands in scientifically substantiating exposome-related efficacy claims.

Mérieux NutriSciences Italia
Skin Exposome in cosmetics, from concept to evidence-based prevention

www.merieuxnutrisciences.com/it/

The skin exposome includes all environmental, lifestyle, and biological factors influencing skin ageing throughout life. Modern cosmetic science increasingly focuses on evidence-based prevention against UV radiation, pollution, oxidative stress, and microbiome imbalance. Recent innovations include **broad-spectrum photoprotection** extending into **visible light, anti-pollution barrier formulations**, **microbiome-friendly** ingredients, and efficacy assessment. The CosmeticLAB integrated and multi-tool approach exploits the synergies of different techniques to test your cosmetics. Regulatory frameworks such as EU Regulation 655/2013 require substantiated claims supported by instrumental and clinical data. The industry is shifting from traditional anti-ageing messaging toward personalized, adaptive skincare strategies designed to **reduce cumulative environmental damage, strengthen skin resilience, and promote healthy, long-term skin ageing.**

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in vivo Efficacy Studies

PhD Trials® is an Leading International Contract Research Organization engaged into the clinical assessment of safety and efficacy of products for topical application (cosmetics and raw materials for cosmetic products).

Advanced Image Analysis

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in vivo Safety Studies
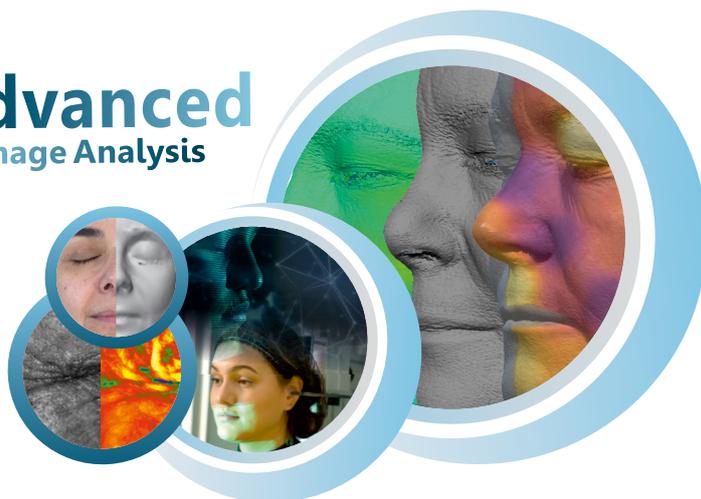
At **PhD Trials®**, we design specific studies to your claims and we are worldwide recognized for having developed some of the most used techniques to substantiate the efficacy of cosmetics products.

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LATEST TESTING OVERVIEW

Mérieux Nutrisciences France
Real-Life Conditions:
A Consumer-Centric Sensory Approach

www.merieuxnutrisciences.com/fr/

How do you ensure a **«longwear» claim** stands up to the **reality of everyday life**? We propose a sensory approach where the consumer serves as the test subject, evaluating your products under **real-life conditions** (pollution, stress, physical activity). Our protocols (including complete designs and comparative groups) enable the evaluation of **complex parameters, such as makeup hold** with a primer, fragrance longevity, or curl definition etc. Our **qualified experts** evaluate results directly on volunteers at key intervals, combining the reliability of expert measurement with the authenticity of real-world consumer experience.

Ellead Empowers Innovation Through Advanced Oral Care and Dermatological Procedure Evaluations

www.ellead.com/eng/

Ellead is **Korea's first human application testing institute** specializing in cosmetics and provides efficacy and safety evaluation services for cosmetics, health functional foods, quasi-drugs, and beauty devices. To meet the needs of global clients, Ellead also offers specialized studies for **oral care products** and **dermatological procedures**. Oral care testing is conducted with licensed dentists and includes assessments such as **halitosis** reduction, **tooth whitening** and **gloss**, **gingival health, plaque** and **tongue coating improvement, dentin hypersensitivity relief, dry mouth relief, oral antioxidant efficacy,** and **oral mucosal safety**. Dermatological procedure studies are led by an experienced in-house dermatologist and cover treatments such as Fraxel, Mirajet, laser toning, scaling, V-RO Advance, and injectables. Ellead also evaluates cosmetic use alongside dermatological procedures. All studies are IRB-approved and designed to support **both marketing claims and regulatory submissions.**

Microfactory's Biomimetic Skin Technologies:
Bridging Skin Physics and Cosmetic Performance

www.microfactory.com
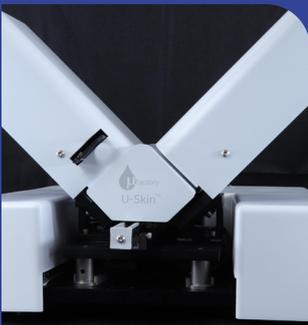
In cosmetic R&D, a persistent challenge remains translating complex skin physics into reliable, actionable performance data. Traditional in vitro models often lack realism, while tests on volunteers are costly, slow, and difficult to reproduce. Microfactory addresses this gap by developing biomimetic skin platforms designed to connect fundamental science with industrial decision-making.

At the core of Microfactory's approach are synthetic skin models combining polymer science and microfluidics. U-Skin® reproduces the dynamic production of sweat and sebum on a controlled surface, enabling accelerated testing where one hour corresponds to a full day of real-life exposure. This makes it possible to observe, in a reproducible manner, how ingredients and formulations interact with physiological fluids over time. T-Skin®, dedicated to transepidermal water loss, models the physical mechanisms of barrier function and permeability, allowing precise evaluation of occlusion, film formation, and barrier repair.

These platforms are intentionally designed to serve the entire cosmetic R&D pipeline. At the ingredient level, they enable rapid functional screening and ranking. For formulations under development, they provide objective data to guide optimization and performance trade-offs. For finished products, they support benchmarking and claims substantiation with quantitative, reproducible measurements.

In 2025, this dual scientific and industrial relevance was formally recognized. Microfactory's work was selected among the Top 10 oral presentations at IFSCC, highlighting the robustness of its physical models and data quality. In parallel, the company received an Innovation Award from the Italian cosmetics industry, acknowledging the tangible value of these technologies for real-world R&D. Together, these achievements confirm Microfactory's vision: transforming skin science into practical tools that accelerate innovation, reduce uncertainty, and bring measurable performance back to the heart of cosmetic development.»

EXPERT ARTICLES

Kamax & Trasnderma Systems
Dual Cuticle Integrity Protocol: a new benchmark in hair evaluation

www.kamax-innovative.com | www.transderma.fr/
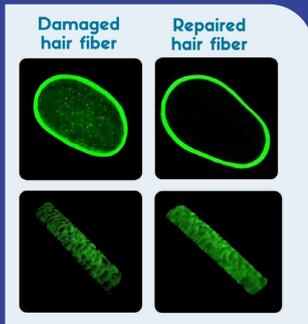
Transderma Systems and Kamax Innovative System have jointly developed the dual cuticle integrity protocol, an advanced evaluation method designed to objectively assess the efficacy of hair care products and devices. This protocol enables, within a single study, the simultaneous analysis of two complementary dimensions of hair "health": cuticle porosity, reflecting the integrity of the cuticle barrier, and surface roughness, a key indicator of cuticle scale condition and overall hair surface quality. Together, these parameters provide a coherent and physically grounded assessment of cuticle integrity, directly connected to the performance claims commonly made in hair care.

Cuticle porosity is assessed through the diffusion of a calibrated fluorescent tracer, analysed by confocal microscopy on transverse sections of hair fibres. The extent of tracer penetration enables precise quantification of cuticle permeability and cohesion. In parallel, surface roughness is quantified using XFluo® 3D imaging technology, developed by Kamax Innovative System. High-resolution three-dimensional reconstruction of the hair surface allows measurement of the Rq parameter, providing robust and reproducible data on cuticle smoothness and surface uniformity. Both measurements are performed on the same hair tresses, before and after product application, under strictly standardised experimental conditions. This unified approach ensures direct comparability of results and a consistent interpretation of product effects on the external structure of the hair fibre.

The dual cuticle integrity protocol is applicable to all hair types (traight, wavy, curly or coily) and across multiple ethnic origins, including Caucasian, Asian and South American hair. It also integrates controlled stress conditions, such as thermal exposure, chemical treatments (including bleaching), and environmental stressors such as UV radiation, enabling realistic simulation of consumer use conditions. By combining quantitative measurements with structural imaging of the hair fibre, the protocol supports claims related to protection against external aggressions, reinforcement of cuticle cohesion, repair of damaged cuticles, cuticle smoothing, and reduced damage induced by thermal tools or bleaching processes.

The dual cuticle integrity protocol will be presented at in-cosmetics, booth 1C70b (Transderma Systems) and booth 2L40 (Kamax Innovative System).

DermaProof Asia
Your complete partner for cosmetic compatibility testing

www.dermaproofasia.com

Cosmetic products are intended for application to the external parts of the body or to the teeth and oral mucosa. From the consumer's perspective, they are expected to be safe, effective, pleasant to use, and truthful in their claims. To meet these expectations, DermaProof Asia provides cutaneous, ocular, and oral compatibility testing designed to confirm safety under real-use conditions.

These services are conducted in collaboration with a multidisciplinary team of experienced physicians, including dermatologists, ophthalmologists, and a dentist, who evaluate the occurrence of physical and functional signs following repeated product use, typically over a four-week period. Cutaneous compatibility, performed by a dermatologist, verifies that a cosmetic product is safe for regular, long-term use, does not induce irritation, allergic reactions or other adverse effects, and is suitable and comfortable for the targeted skin or hair type (e.g. sensitive skin). This assessment can be complemented by patch testing and comedogenicity or acnegenicity studies.

Ocular compatibility assessment is conducted by an ophthalmologist and includes subject interview, slit-lamp examination of the eyelids, cornea, and conjunctiva, and measurement of the Tear Film Break-Up Time (TBUT) to assess tear film stability. DermaProof Asia also offers direct instillation tests to support "no tears" claim, reinforcing confidence in product safety for this highly sensitive area. Oral compatibility, carried out by a dentist, ensures that products (toothpaste, mouthwash) are well tolerated by the oral mucosa and gingival tissues.

Together, cutaneous, ocular, and oral compatibility testing demonstrate that a cosmetic product is well tolerated on is intended area of application and support popular claims such as "clinically tested", "dermatologically tested", and "ophthalmologically tested".

EXPERT ARTICLES

Vaiomer: Expert in Microbiome Analysis for Skin, Hair, and Oral Samples

www.vaiomer.com
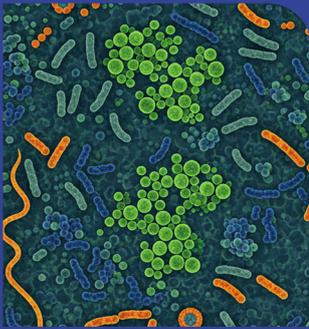
Vaiomer is a French company specializing in metagenome and microbiota analyses, as well as comprehensive bioinformatics services, across diverse biological samples—human, animal, and environmental.

As a globally recognized leader in microbiota analysis for low-biomass and complex samples beyond the gut, Vaiomer offers specialized expertise in skin, oral, and hair microbiomes. We provide advanced analytical solutions specifically designed for the dermocosmetic industry. Our innovative methodologies enhance understanding of skin health and homeostasis, support the development of personalized and microbiome-friendly skincare formulations, and deliver critical insights into the efficacy and safety of dermocosmetic products, active ingredients, probiotic skincare, and oral care solutions.

Beyond technical excellence, Vaiomer is committed to delivering rigorous quality results and comprehensive client support. Certified for Research Tax Credit (Agrément CIR), we offer both integrated analysis packages and fully customized analytical services tailored to specific research needs.

Our optimized methodologies enable microbiota analysis from diverse skin samples, including swabs, adhesive tapes, patches, biopsies, explants, and hair follicles and include:

Wet Lab Processing: Optimized DNA extraction protocols for various sample types | Custom primer design for prokaryotic and eukaryotic targets.

Integrated Sequencing Analysis: 16S rDNA sequencing for comprehensive bacterial community profiling | ITS sequencing for fungal community analysis | Shotgun metagenomic sequencing for in-depth microbiome characterization and functional profiling | *tuf* gene sequencing for precise *Staphylococcus* species identification | *Cutibacterium acnes* SLST (Single-Locus Sequence Typing) for strain-level resolution | Custom SLST design for specific research requirements | Host transcriptomics (RNA-seq).

Quantification Methods: High-precision quantification of standard or custom-designed targets, including taxonomic and functional profiling of bacteria, fungi, Demodex, and host genes using quantitative PCR (qPCR), digital PCR (dPCR) for high-sensitivity quantification or PCR array quantification for cost-effective multi-target analysis.

Advanced Bioinformatics and Statistical Analysis: Customized data interpretation | Dedicated scientific support throughout your project.

Brain Impact Neuroscience Measuring emotion benefits in cosmetics through neuroscience

www.brainimpact.eu

At a time when consumers' sensory and emotional experiences have become decisive drivers of product preference, Brain Impact Neuroscience offers a scientific methodology to demonstrate the emotional benefits of cosmetic products. The company relies on fMRI (Functional Magnetic Resonance Imaging), a methodology that provides objective evidence to measure and scientifically validate neural brain responses to products. This neuroscientific expertise is directly applied to the cosmetic industry.

Scientific research conducted by Brain Impact Neuroscience has shown that certain odors can produce lasting effects on the activity of brain networks at rest, even after exposure. In other experimental contexts, a "positive odor" can also increase the synchronization of brain activity between multiple individuals sharing the same emotional experience, with an even stronger effect when the emotion experienced is negative. These findings provide valuable insights into how scents shape emotional responses at both individual and collective levels. Other studies by Brain Impact Neuroscience have focused on quantifying the impact of products' sensory properties, such as texture on neural responses associated with pleasantness and wellbeing.

In a study conducted for Lucas Meyers Cosmetics on the Pickmulse cream, EEG and fMRI data revealed that differences in texture significantly enhanced sensations of pleasant touch and reward during application.

The results demonstrated that the introduction of a single innovative emulsifying ingredient is sufficient to modulate the tactile experience, and highlight the powerful role of formulation in shaping consumers' emotional responses. This neuroscientific approach provides objective and quantifiable evidence of emotional benefits, ranging from an immediate feeling of well-being to the development of long-term emotional attachment.

To fully capture the complexity of these responses, Brain Impact Neuroscience stands out through its high level of scientific rigor, relying on the integration of multimodal data through artificial intelligence to enrich fMRI data analysis with the client partner's existing data, delivering a holistic, 360° understanding of consumer responses.

SHAPYPRO: Your Partner in Stability and Physicochemical Testing.

Cosmetic Stability Testing According to ISO 18811:2018. The Importance of Stability in Cosmetics

In the cosmetic industry, ensuring product quality and consistency throughout its shelf life is not optional—it is essential. Stability testing, supported by detailed physicochemical analysis, is a fundamental tool to confirm that products remain safe, effective, and aesthetically stable under typical storage and usage conditions. The international standard **ISO 18811:2018** provides structured guidance for implementing stability evaluations with consistency and scientific rigor.

What Stability Testing Evaluates

Stability testing assesses a product's ability to maintain its physical, chemical, microbiological, and functional characteristics over time. These studies help identify the effects of environmental stress—such as light, temperature, and humidity—on product quality. Through these evaluations, manufacturers can establish accurate shelf lives, ensure regulatory compliance, and deliver a reliable product experience to consumers.

Types of Stability Studies

Three main types of studies are commonly performed.

- **Preliminary (screening) tests** are conducted on the bulk formula, usually in inert glass containers, without the final packaging. These early studies help detect visible or measurable instabilities.

- **Accelerated stability testing** is applied to the finished product in its commercial packaging under elevated temperature and humidity conditions. This approach simulates extended storage to predict long-term behaviour.

- Simultaneously, **long-term stability tests** must be carried out under standard environmental conditions, using the final packaging to verify and validate predictions made during the accelerated phase.

ISO 18811 highlights the significance of studying **interactions between the product and its packaging.**

SHAPYPRO: Your Testing Partner

At **SHAPYPRO**, we offer complete stability and physicochemical testing services, fully aligned with ISO 18811:2018. From formulation development through to regulatory support, our experienced team ensures that your cosmetic products meet high standards of safety, quality, and market readiness through scientifically sound and dependable testing strategies.

THE SCIENCE BEHIND SAFETY

At **SHAPYPRO**, we provide specialised services in applied microbiology, challenge testing, and stability studies to ensure that your products meet the highest standards of quality and safety.

Shapypro

www.shapypro.com

SCIBASE

Nevisense: A Sensitive Tool for Skin Barrier Assessment in Cosmetic Testing

www.scibase.com

Nevisense is a non-invasive tool for monitoring skin barrier function with several applications in beauty, cosmetics, and personal care. Its advanced Electrical Impedance Spectroscopy (EIS) is emerging as a powerful technique for evaluating skin barrier function with high sensitivity and reproducibility. Nevisense has been featured in over 85 studies to date, providing quantitative insights into hydration status, inflammation, and stratum corneum integrity.

The EIS technology goes beyond traditional methods of skin barrier analysis by capturing features of tissue health and cellular changes. Methods such as transepidermal water loss (TEWL) remain widely used, but their results are influenced by external factors such as ambient humidity, temperature, or caffeine intake. EIS measures the skin's electrical impedance, offering a more robust assessment of barrier function. Recent comparative studies (e.g. Huygen et al., 2024) have shown greater sensitivity of EIS in detecting subtle physiological changes both in vitro and in vivo compared to TEWL.

Applications of EIS extend beyond basic skin hydration analysis. Nevisense has been employed to monitor inflammatory changes, UVB-induced damage, and oxidative stress effects on the barrier (Hernandez et al., 2019; Rinaldi et al., 2023). It also supports longitudinal tracking of skin responses to topical treatments, providing objective data on efficacy (Yayci et al., 2024).

With the cosmetic industry pushing for more robust and evidence-based testing methods, EIS is increasingly incorporated into product evaluation as a trusted tool for skin analysis. Nevisense offers a non-invasive, sensitive, and quantifiable means of assessing skin physiology, enabling researchers to track subtle changes and treatment effects with greater accuracy. As the field continues to evolve, EIS is emerging as a cornerstone of skincare research with its potential to enhance product development and improve patient outcomes.

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Abstract

CES 2026 marks a definitive transition for the beauty industry, moving away from traditional cosmetics toward a sophisticated technological ecosystem merging healthcare, data science, and holistic wellness.

Driven by innovations from players like Byome Labs and Amorepacific, the sector is shifting toward precision beauty through real-time microbiome analysis, AI-driven diagnostics, and advanced cutaneous sensors. This evolution replaces standardized routines with objective, longitudinal monitoring and predictive analytics, effectively blurring the lines between consumer aesthetics and clinical dermatology to deliver hyper-personalized, data-backed interventions.

Keywords

Beauty Tech, Microbiome Analysis, A.I., Predictive Analytics, Med-Tech Convergence, Skincare, Cutaneous Sensors

New methods in beauty, new trends and innovative solutions to evaluate in-vivo cosmetics efficacy

CES 2026 confirms a pivotal paradigm shift: beauty has transcended traditional cosmetics to become a sophisticated, **intelligent technological ecosystem** at the intersection of healthcare, data science, and holistic wellness. The integration of **artificial intelligence (AI)**, advanced cutaneous sensors, biological assays, and connected devices is fundamentally re-engineering how skin is monitored, understood, and treated. This convergence marks the industry's entry into an era of **advanced personalization**, rooted in objective quantification and predictive analytics rather than standardized routines.

At the core of this revolution lies increasingly granular and continuous skin monitoring. Platforms such as **Skinsight**, a collaborative development between **Amorepacific** and **MIT**, exemplify this trend by merging ultra-thin electronic patches with environmental sensors and AI. By measuring real-time UV exposure, humidity, temperature, and mechanical skin strain, these technologies characterize the cutaneous "**exposome**" to anticipate physiological changes. Similarly, professional-grade solutions from **KC Technology**—utilizing high-definition digital microscopy and diagnostic software—are empowering experts to deliver clinical-grade assessments of the skin and scalp, bridging the gap between consumer experience and clinical dermatology.

A standout at CES 2026, the French biotech firm **Byome Labs** garnered significant attention with its flagship innovation: **Byome Derma.** This disruptive point-of-care solution enables **skin microbiome analysis** directly at the retail counter in under three minutes.

Leveraging the rapid turnaround of antigen-style assays, the device quantifies **25 biological parameters** to recommend hyper-personalized skincare regimens. By synthesizing cutting-edge microbiology with AI, the technology deciphers complex microbial protein signatures, including diversity and equilibrium indices for key bacteria such as Cutibacterium acnes, Staphylococcus aureus, Staphylococcus epidermidis, Malassezia spp., and Corynebacterium. Furthermore, Byome Derma identifies **sensitivity signatures** by detecting pro-inflammatory markers and oxidative potential. In doing so, Byome Labs transforms cosmetic purchasing into an **objective scientific diagnosis**, representing a decisive step toward precision beauty.

This profound biological insight paves the way for truly individualized interventions. The **Scar Beauty Device** by Amorepacific—recipient of a **CES 2026 Best of Innovation Award**—is a prime example. Through AI-driven automated analysis, the device identifies scar morphology and condition before executing a single-step targeted treatment combined with aesthetic camouflage perfectly calibrated to the user's skin tone. Here, treatment and appearance are no longer decoupled; they are integrated into a functional, immediate solution that meets modern consumer demands for efficacy and speed.

Concurrently, **cutaneous biology** is becoming the cornerstone of personalization strategies. **PurelyBiome** offers an approach centered on facial microbiome profiling, revealing how bacterial homeostasis influences hydration, sensitivity, and senescence. These biological datasets enable formulations that go far beyond superficial product selection. This vision aligns with platforms like **TwinSkin.care**, which employs AI for longitudinal wound tracking and clinical care optimization, demonstrating that beauty tech and med-tech now share a unified foundational framework.

Wearable sensors also play a vital role in this transformation. Companies like **PraxaSense** are developing advanced optical sensing technologies capable of providing reliable physiological data across all **Fitzpatrick phototypes.** Meanwhile, **PointFit Technology** utilizes smart patches for continuous sweat analysis, extracting real-time health biomarkers. These innovations reinforce the concept of beauty as a component of global health, where the skin serves as a primary **data interface**.

This intelligence is even being embedded into everyday objects. The **NanoHydra Pro by inewme** illustrates the seamless integration of AI into routine gestures like hydration. Featuring adaptive delivery systems and sensors, the device automatically modulates its moisturizing mist to optimize absorption and efficacy. Such solutions prove that high-tech sophistication can remain discrete and intuitive while delivering measurable results.

The innovations showcased at CES 2026 delineate a clear trajectory: the **rise of predictive, quantifiable, and connected beauty**. AI is no longer limited to static image analysis; it now monitors skin longitudinally, learning from physiological reactions to adapt care in real-time. As the boundaries between cosmetics, wellness, and medical health continue to blur, a holistic vision of self-care is emerging. Ultimately, CES 2026 represents a strategic inflection point for the industry—a move toward a technological field where scientific precision, user experience, and tangible efficacy supersede generic marketing promises.

Anne Charpentier,
Founder of Skinobs
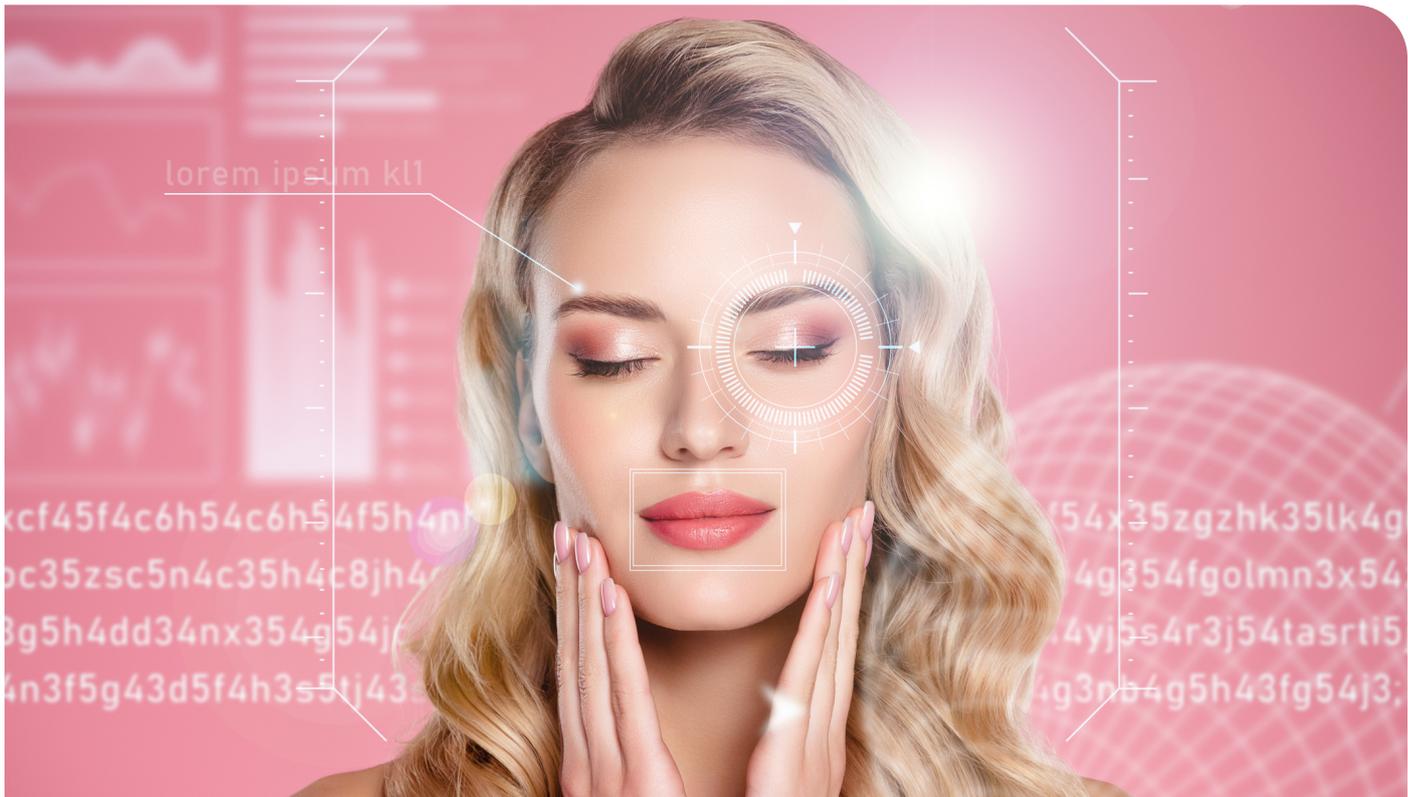
Interview

Decoding Cutaneous Bioavailability: Analytical Frontiers in Skin Absorption and Diffusion Pathway Characterization

Sébastien Grégoire
Scientific Consultant

From analytical chemistry to skin biology, Sébastien Gregoire supports the development of innovative topical products through skin absorption filter. His 25 years of experience in Pharmaceutical and cosmetic industry allows him to assist development of topical products from early in silico stage to ultimate in vivo proof. Author and co-author of more than 50 articles covering all aspects of skin bioavailability, Sébastien Grégoire participated in international collaboration through Cosmetic Europe programs. His freelance activity founded in 2024 addresses any questions related to topical exposure including analytical support.

MARKET INSIGHTS

How is cutaneous bioavailability defined?

The bioavailability reflects the ability of the chemical to reach the **systemic circulation** after a given route of administration. Obviously, it includes the ability of the chemical to pass the barrier (gut, lung, skin…) and local metabolism. From a pharmacokinetic point of view, bioavailability is defined using pharmacokinetic (PK) data. For a given route of exposure, the bioavailability is the ratio of AUC (Area Under the Curve) of the route of administration divided by the AUC of Intravenous route, corrected for dose ratio if necessary.

For cosmetics, topically applied, PK data is usually not available. Another definition is used to measure skin bioavailability. It is defined as the fraction of parent chemical found in the viable part of the skin (e.g. Viable Skin + Dermis + Receptor Fluid) after topical exposure to in-vitro skin. Of course, such a definition implies that the skin is metabolically active for chemical metabolized in the skin. Otherwise, the skin bioavailability is overestimated. In the same way, if radiolabeling is used with simple scintillation counting and metabolism or chemical degradation takes place, the skin bioavailability is overestimated as it includes parent and metabolites/degradation products.

Skin bioavailability has another level of difficulty compared to the other routes of administration. The **skin bioavailability depends on the dose but also on the duration of the exposure**. For this reason, skin bioavailability is measured over 24 hours, or for rinsed product such as hair dye, after 30 min exposure time followed by 23.5 h post exposure. Thus, skin bioavailability is the sum of ADME process occurring locally in the skin.

Skin is a complex organ with different diffusion pathways. What are they? How are they differentiated?

Skin is complex organ made of different layers. Among the different layers, Stratum Corneum (SC) is defined as the rate limiting step. Modelled as a simple homogenous membrane in the Potts & Guy relationship. This assumption does not reflect the real structure of the SC, which is a composite membrane typically describes as a brick-and-mortar structure. **According to its physic-chemical properties, a chemical can pass through the lipid domain and/or through the corneocyte**. The situation is even more complicated. Indeed, the corneocyte is surrounded by a cornified envelope and a lipid envelope. Corneocytes are connected one to each other by corneodesmosomes [1] (Sjövall et aL 2024). These sub-compartments can contribute to the chemical diffusion. As a first intention, lipophilic chemical passes preferentially through the lipid domain. Nevertheless, corneocytes could have a significant contribution to the diffusion of **lipophilic chemicals.**
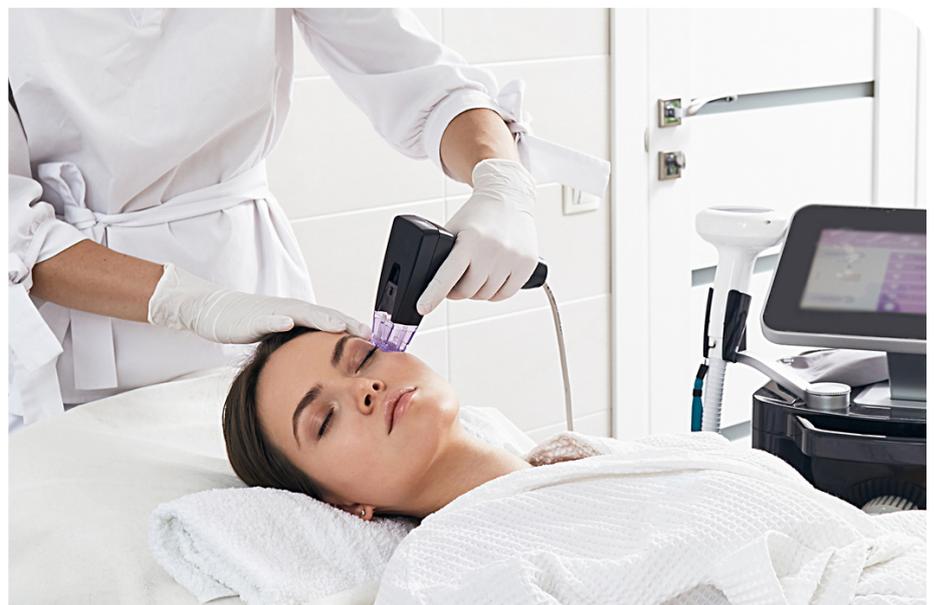
Hydrophilic chemicals pass through the skin more than expected based simply on the lipophilic properties of the SC. Appendages such as hair follicle is another route of absorption through the skin. Many studies support its contribution. Sebastia-Saez et Al quantified recently the contribution of transfollicular route to the skin permeability [2]. It represents up to 50% for hydrophilic chemicals and decreases for lipophilic chemicals. **Lipophile chemicals can also pass through the hair follicle**, but their permeability is limited with possible accumulation in sebaceous gland as observed on MALDI imaging [3]. Contribution of hair follicle is not enough to explain the skin permeability of hydrophilic chemicals. Existence of a polar pathway was proposed. It could be related to imperfections in the SC lipid layers. Such imperfections could affect the integrity of the frozen skin submitted to freeze-thaw cycling, which would rather affect the hydrophilic chemicals [4].
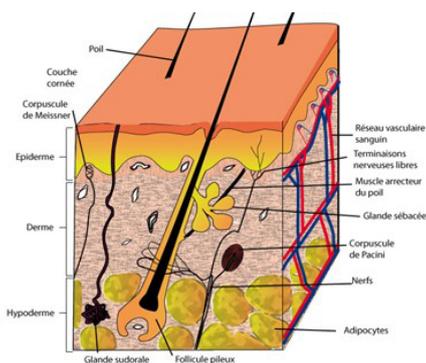
This brief description of different diffusion pathways in the skin points out the complexity to model the skin bioavailability. It can explain also the **difference on skin permeability according to the anatomical site**, such as forehead or scalp compared to back or forearm [5, 6].

Which methods can be used to characterize these pathways?

In vivo evaluation should be the most appropriate to measure effectively the skin bioavailability. Nevertheless, it addresses some difficulties. The method must be none invasive, excluding possibility of biopsies. Tape stripping can be used to monitor skin absorption. It is recognized for bioequivalence of topical products. Using appropriate protocol, kinetic information can be obtained by tape striping. However, it does not provide quantitative information on skin bioavailability. **Raman spectroscopy** and related methods have been greatly improved over the last years, thanks to data treatment and laser performance allowing the development of SRS, CARS. These spectroscopic methods provide concentration profile in vivo in the skin. The main limitation is related to the lack of specificity of spectroscopic method which can be overcome using labeling using deuterated chemical or partially with data treatment.

Obviously, measurement of skin bioavailability requires an **ex vivo skin set up on a diffusion cell**. Using an appropriate analytical method, the chemical is then quantified in the different skin layers. The measurement of skin permeability or skin bioavailability does not provide any information about the pathway used by the chemical to pass through the skin.

Combination of models and methods has to be used to define properly the diffusion pathway, firstly to investigate contribution of transfollicular route, the model must have follicles. Abdominal skins obtained from surgery have lack of follicle. For such study, inner face of pig ear skin is a suitable model. Pig skin is the only animal recognized as a good surrogate of human skin. Difference between pig and human skin could be due to the contribution of hair follicle. Different methods can be used to demonstrate the **transfollicular route**: hair follicle plugging, differential stripping, differential Sampling by micro-biopsy or imaging methods (such as MALDI, fluorescence). Each method has its pros and cons. The method is selected according to the information requested. If the information is about the ability of the chemical to reach sebaceous gland through the hair follicle, imaging method is appropriate. If the contribution of the transfollicular route to the **overall permeability** is searched, the plugging method has to be used. Whatever the method used, such study is unusual and requires specific and dedicated experiments.

To define precisely the diffusion pathway in the SC, method with enough **high spatial resolution** has to be used. Indeed, thickness of lipid layer between corneocyte is within 100 nm range and thickness of corneocyte is about 1 µm. Method such as SIMS does not have enough high resolution, typically with the µm range. Thus, it cannot be localized precisely lipid domain. An alternative is to use 3D-SIMS allowing the possibility to visualize at the nm range the distribution within the SC [1]. Spectroscopic technic such as CARS can also visualize the diffusion pathway in a confocal way [7].

A **balance between question addressed, methods performance and outcome**, models characteristics, study cost and timing allow to define properly the most appropriate approach.

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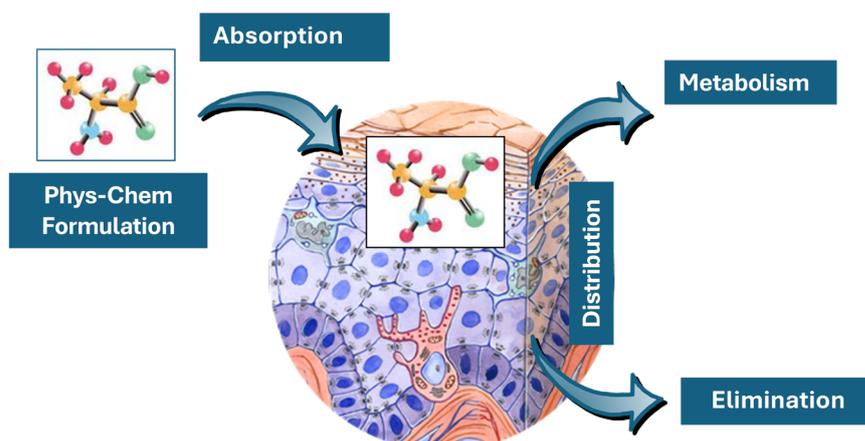
Interview

Optimizing Regulatory Compliance in Cosmetics: Navigating AI tools and Avoiding Hallucinations

Corinne Benoliel
Doctor of Pharmacy, microbiologist and safety assessor - Founder and manager of Institut Scientis

Carole Benoliel began her career at Patrick Alès' cosmetics company as head of the control laboratory. She then took over as head of R&D and regulatory affairs at Laboratoires Prodene Klint. She became director of the Institute for Microbiological Research. After a career rich in diverse experiences, she decided in 2016 to create her own scientific services company: Institut Scientis, specializing in regulation, microbiology, toxicology, and the design of cosmetics, biocides, detergents, disinfectants, candles, and home fragrances. The offices and laboratory of Institut Scientis (CIR and CII certified) are located in Montmartre, and the company is a Qualiopi-certified training organization for its training activities. Corinne Benoliel also teaches the university diploma course "Toxicological Safety Assessor for Chemicals and Cosmetics."

More specifically within the cosmetics sector, how should bibliographic research be conducted using AI?

Artificial Intelligence can facilitate the identification and collation of targeted scientific publications, primarily due to its conversational interface. The user may pose precise queries, refine searches through successive iterations, and rapidly obtain a selection of pertinent documents.

To **guarantee the reliability of results, it is essential to utilize an AI equipped with a RAG** (Retrieval-Augmented Generation) **architecture**. This method integrates a large language model with an advanced search engine, enabling the AI to query scientific or regulatory databases in real-time before generating a response. Consequently, the information provided is anchored in referenced sources, thereby mitigating the risks of extrapolation or error.

Caveat: Even when employing RAG, expert intervention remains indispensable to analyze the delivered outputs, systematically verify cited sources, and cross-reference information, as AI systems may occasionally omit granular details or misinterpret complex data. For optimal research, it is advisable to use specialized tools and formulate queries using precise keywords and appropriate filters (dates, document types, etc.).

For instance, in the context of research regarding the sensitizing potential of a cosmetic substance, utilizing an **AI with a RAG approach minimizes "hallucinations"** by relying on reliable and precise sources, such as PubMed, SCCS opinions, or ECHA data, provided these sources are explicitly specified within the query.

In your view, which open-access AI tools could be beneficial within the field of cosmetic regulation?

As a general principle, priority should be given to AI systems that explicitly cite their sources.

Below are **several recommended solutions** categorized by use case:

• Information Retrieval: Le Chat, ChatGPT, NotebookLM, Perplexity
• Bibliographic Research: Consensus, Elicit, Perplexity, SciSpace AI, Scopus AI, Web of Science Research Assistant
• Document Drafting: Le Chat, ChatGPT, Claude, Copilot, Gemini, Perplexity, QuillBot
• Translation: ChatGPT, DeepL, Google Translate, QuillBot
• Scientific Manuscript Writing: ChatGPT, Elicit, Paperpal, Perplexity, QuillBot, Rubriq
• Scientific Figure Generation Adobe Firefly, BioRender, DALL·E 3, Flux 1.1, Gemini, Midjourney, Wolfram Alpha
• Computer Code Development: ChatGPT, Claude Code, Cursor, GitHub Copilot, Mistral, Perplexity

How would you define the fundamentals of Generative AI?

A.I. refers to algorithms capable of analyzing data, learning, and responding to queries formulated by humans. Generative AI distinguishes itself by generating new data. When engaging with AI, it is essential to master the following terminology:

• LLM (Large Language Model): An architecture of generative artificial intelligence (neural network) trained on massive datasets to learn how to generate natural language through probabilistic modeling.
• Prompt: An instruction or a set of data provided by a human to the AI. Its clarity is paramount to ensure the AI responds accurately and addresses the specific problem statement.
• Chatbot: A computer program designed to simulate and process human conversation. It requires iterative dialogue to "challenge" the system and refine its output.
• Training: The process by which the AI learns to predict the subsequent word in a sentence based on the preceding context. An AI must undergo rigorous "training" to achieve a satisfactory level of proficiency in the user's target domain and to generate pertinent responses.
• Hallucination: A false or misleading response generated by the AI, presented as an established fact.

Is it possible to delegate the data collection required for drafting Part A of a Cosmetic Product Safety Report (CPSR) to AI?

The information necessary for completing Part A of the Safety Report is centralized by the Responsible Person. This individual gathers data from suppliers (regarding raw materials and packaging) and internal teams (such as formulators for finished product data).

The collection of this data cannot be fully automated or delegated to an AI, due to its dispersed nature and inherent diversity. Once the documents have been compiled, they may be stored within a **secure environment** (a corporate server or a French or European hosting provider).

An AI utilizing the RAG (Retrieval-Augmented Generation) method can then extract pertinent information, provided that the prompts are specific and adapted to both the various regulatory chapters and the structural format of the documents (tables, lists, prose, etc.).

For instance, it is more efficient to provide the AI with a **precise list of allergens** to be identified, according to current regulations, rather than requesting their identification without guidance. Nevertheless, **expert intervention remains indispensable** to validate the outputs, particularly to ensure that certain allergens (present in non-fragrance raw materials, for example) are correctly identified.

Given the diversity of document formats and the time required for prompt engineering (which necessitates human expertise), it is legitimate to question the actual time-efficiency gain provided by this approach.

Could you provide a practical case study of bibliographic research?

To illustrate the aforementioned points, I conducted a test regarding the sensitizing potential of phenoxyethanol (CAS 122-99-6) by providing the AI with the following instruction: «*Can you identify the sensitization potential of phenoxyethanol?*». Three open-access AI systems indicated that this preservative is a sensitizer, even specifying it as a skin sensitizer (H317).

Following several iterations and specific guidance on my part toward ECHA and SCCS sources, I obtained the following data: **Phenoxyethanol is not classified as a skin sensitizer in Annex VI** of the CLP Regulation, and there are no current intentions to classify it for this hazard. The SCCS, in its opinion SCCS/1628/21, confirms that phenoxyethanol is not considered a skin sensitizer at current concentrations of use, though it recommends maintaining the 1% limit as a precautionary measure.

This approach accelerates the bibliographic review but necessitates the **intervention of a human expert** to verify the sources and their overall relevance. In summary, the RAG process employed here allowed the AI to rely on reliable and contextualized data, thereby strengthening the pertinence and traceability of the results. The fundamental principles for information retrieval remain the **cross-referencing of sources** and the verification of obtained data, while maintaining extreme vigilance regarding the fact that certain AI systems may store and reuse queries.
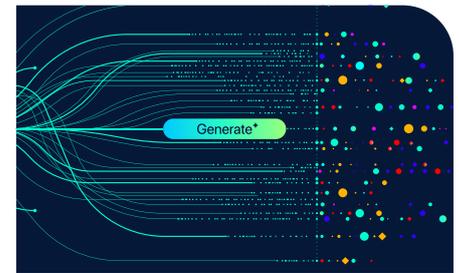
In your view, how should the framework for confidentiality and data protection be defined with AI?

The primary concern that arises when querying an AI is that of confidentiality; this concept is fundamental. To address this, it is essential to understand the extraterritoriality clause of the 2018 US Cloud Act (Clarifying Lawful Overseas Use of Data). Succinctly stated, this federal law contains provisions that authorize U.S. authorities to access data hosted by American companies, even when such data is stored abroad, including within Europe. This clause, therefore, stands in direct conflict with the GDPR (General Data Protection Regulation) and European business data protection laws, as it facilitates data transfers without European consent or oversight. Given that most AI systems are hosted on American servers, confidentiality is not guaranteed. Even Mistral, a fully French entity, may utilize American servers hosted on French soil. To ascertain an AI's level of on reliable and contextualized data, thereby strengthening the pertinence and traceability of the results. The fundamental principles for information retrieval remain the cross-referencing of sources and the verification of obtained data, while maintaining extreme vigilance regarding the fact that certain AI systems may store and reuse queries. confidentiality, it is imperative to consult the Terms of Service (ToS). As these documents are invariably dense and complex, the involvement of legal counsel or cybersecurity specialists may prove necessary.

What are the fundamental principles to observe when utilizing AI?

• Legal Responsibility: The human author who produces content based on data derived from an AI bears full legal liability.
• Data Integrity: The user must ensure that sensitive information, confidential data (not in the public domain), or personally identifiable information (PII) is not transmitted within prompts.
• Due Diligence: Should any doubt arise regarding sensitive data, the AI's Terms of Service must be reviewed prior to use.
• Input Dependency: The outputs delivered by the AI are strictly dependent on its input data.
• Critical Assessment: AI users must critically evaluate the accuracy of the provided data, its transparency (availability of sources), associated confidentiality and security (notably hosting locations), the intellectual property rights of the obtained data, and the justification for utilizing AI in light of its environmental impact.

BYOME
LABS

SCIENTIFIC VALIDATION
OF MICROBIOME
RELATED CLAIMS*

Dybiosis rebalancing
(acne, atopic dermatitis, dandruff...)
& Microbiome Respect

MICROBIOME RESPECT
SCIENTIFICALLY PROVEN BY **BYOME LABS**

Skin

Scalp

Oral

Vaginal

*tests in vitro conducted in laboratory

Abstract

The dermo-cosmetic industry is undergoing a paradigm shift toward a predictive, data-driven ecosystem where objective quantification supersedes generic claims. This evolution centers on the systematic integration of cutaneous biomarkers, molecular, proteomic, and lipidomic, measured via non-invasive modalities. While historical assessments are relied on in vitro models, modern breakthroughs utilize adhesive tape-stripping, swabbing, and microfluidic extraction of dermal interstitial fluid (dISF). Synergized with high-throughput «omics» platforms and AI, these techniques enable precise detection of functional markers and microbiota profiles. This convergence facilitates hyper-personalized skincare, bridging laboratory precision with real-world applications to position skin as a vital diagnostic interface for holistic health.

Keywords

Cutaneous Biomarkers, Omics, Non-invasive Sampling, Dermal Interstitial Fluid, AI Diagnostics, Exposome, Personalized Dermocosmetics.

How Skin Biomarkers Redefine Efficacy Claims

CES 2026 confirms a major evolution: beauty is no longer merely a matter of cosmetics, but is becoming an intelligent technological ecosystem at the crossroads of health, data, and well-being. Artificial intelligence, skin sensors, biological analysis, and connected devices are profoundly transforming the manner in which the skin is observed, analyzed, and treated. This convergence marks the entry of beauty into an era of **advanced personalization,** founded upon objective measurement and anticipation.

At the heart of this revolution, skin analysis is becoming increasingly granular and continuous. Platforms developed by Korean brands and high-ranking research institutes illustrate this trend by combining ultra-thin electronic patches, environmental sensors, and AI. By measuring real-time UV exposure, humidity, temperature, and even skin micro-deformations, these technologies enable the **modeling of the cutaneous «exposome»** and the anticipation of its progression.

The analysis of cutaneous biomarkers has become a strategic pillar for brands and CROs, enabling the objectification of product efficacy and the advancement of hyper-personalization. By 2026, the convergence of innovative **sampling, high-tech platforms, and AI** is redefining cosmetic evaluation. Driven by digitalization, the industry addresses a growing demand for evidence-based skincare. Today's data-savvy consumers require bespoke solutions precisely calibrated to their unique biological profiles, lifestyles, and environmental exposomes.

Fundamental to this **paradigm shift** is the systematic integration of cutaneous biomarkers—spanning molecular, proteomic, lipidomic, and biophysical indicators, which offer profound mechanistic insights into hydration kinetics, epidermal barrier integrity, inflammatory cascades, oxidative stress, and the taxonomic composition of the microbiota. Historically restricted to isolated cellular assays or 3D reconstructed **human skin models (RhE)**, these physiological markers are now quantifiable through sophisticated, non-invasive sampling modalities, such as adhesive tape-stripping, swabbing, and the extraction of **dermal interstitial fluid (dISF)**. A company present at the upcoming Cosmetotest Symposium will present its sampling technology based on hollow microneedles for sampling of dermal interstitial fluid (dISF). Access to endogenous and exogenous biomolecules in dISF represents a unique opportunity for the analysis of vital markers, health conditions, and for research into skin biomechanisms.

When synergized with high-throughput 'omics' platforms, these methodologies bridge the gap between **laboratory-grade analytical precision and real-world, consumer-centric applications**, facilitating a new era of evidence-based dermocosmetic innovation.

The transition from in vitro assessment conducted on skin models or 3D organoid cell cultures, to non-invasive in vivo evaluation represents the technological breakthrough achieved in recent years. Latest-generation omics analytical methods enable the extraction of high-quality biological information from samples harvested at the skin surface via **stripping or swabbing,** without compromising the integrity of the cutaneous barrier. Furthermore, these sampling methodologies are currently the subject of various patents.

This article examines the current landscape and prospective potential of biomarker-driven diagnostics within the dermo-cosmetic sector. By evaluating technological, analytical, and methodological innovations, we illustrate how connected, portable, and

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high-resolution instruments are poised to redefine personalized beauty, shifting cutaneous assessment from qualitative observation toward a predictive and actionable science. In the context of skin biomarkers, one must consider assays that have been traditionally performed for decades, particularly by active ingredient manufacturers. Historically, these evaluations were predominantly conducted **in vitro on epidermal or dermal cell cultures**, facilitated by the fact that lipophilic compounds are more readily tested in submerged monocultures, or on 3D reconstructed human skin models (RhE). Modern iterations of these models have gained complexity, now incorporating specialized appendages such as **microvascular networks or nociceptive neuronal structures.** This evolution was a recurring focal point of scholarly exchange during the poster sessions at the IFSCC 2025 Congress.

In these biomarker-driven assays, three main parameters must be considered:
• The biomarker, a measurable indicator of a cutaneous biological process, is typically a molecule, protein, or enzyme. It may also be a biophysical parameter when measurements are performed directly at the skin surface (impedance, elasticity, color, etc.). Will it be possible in the future to **measure volatile organic compounds (VOCs)?**
• The analytical substrate has evolved rapidly with swabbing and tape-stripping techniques, whose nature does not interfere with analysis. These, in situ, non-invasive, painless samples enable ultra-personalized results that inform product recommendations. **Microfluidic sampling of interstitial fluids** may emerge in the future.
• The analytical method is central to expectations, as it must be reliable and rapid. Beyond classical protein assays such as ELISA or Western blot, omics analyses provide miniaturization, reproducibility, and near-real-time measurement.
Skin biomarkers, as true biological signatures, are now powerful tools for personalized cosmetic and dermocosmetics studies. At the IFSCC congress in Cannes, one of the leading cosmetics company presented the Cell-Bioprint, launched in the USA, performing **proteomic analyses** of three to five proteins to estimate each

consumer's "biological skin age" and provide tailored recommendations.

This revolution in biomarker quantification highlights the diversity of measurable markers, yet a key limitation is that samples predominantly originate from superficial layers. **Swabbing** collects surface cells, suitable for assessing microbiota, hydration, inflammation, oxidation, and overall barrier function, but precludes evaluation of dermal structural biomarkers. **Tape-stripping** reaches slightly deeper epidermal layers, while VOC measurements may offer future avenues, though current sensors remain bulky and lab-confined.

Proteomic analysis of stratum corneum samples (e.g., LC-MS/MS) targets keratins (K1, K10, K14…), filaggrin and derivatives (NMF profile), transglutaminases TG1/TG3, cytokines (IL-1α, IL-1RA, IL-8), and oxidized/carbonylated proteins. Proteomics, analogous to genomics for the DNA detection and metabolomics for the metabolites search, reflects functional outcomes: metabolite detection confirms protein activity and effective propagation of DNA-initiated pathways. Rapid lipidomic methods can additionally measure ceramides, cholesterol, fatty acids, and squalene.

Advanced studies on skin models or explants allow hundreds to thousands of biomarkers to be assessed, using platforms such as **reconstructed skin augmented with capillaries, neuronal cells, microfluidics, or organ-on-chip** devices. These approaches provide a

versatile framework for elucidating skin biology, monitoring individual responses, and developing precision dermocosmetics interventions.

Recently, several companies specializing in microbiota analysis have proposed evaluating the activity of a topical product within minutes using skin sampling. Inspired by the speed of antigenic tests, these miniaturized devices can, for instance, measure **25 biological parameters.** By combining cutting-edge microbiology and AI, these technologies analyze a complex signature of microbial proteins, such as indicators of diversity and balance for **several bacteria** (*Cutibacterium acnes, Staphylococcus aureus, Staphylococcus epidermidis, Malassezia spp., Corynebacterium*…). Some of these diagnostics offer the possibility of establishing a signature of skin sensitivity by detecting inflammation markers and oxidation potential.

Wearable sensors and devices also play a pivotal role in this transformation. Companies are developing advanced optical measurement technologies independent of skin phototype, as well as intelligent patches that analyze sweat to provide continuous insights into the body's physiological state. These innovations reinforce the concept of beauty connected to **holistic health,** wherein the skin becomes a data interface in its own right.

Regarding biophysical, connected, and portable measurements for decentralized use, Barlier, Servant, et al. (2024) provided a comprehensive longitudinal

study demonstrating that current mobile device parameters increasingly align with standardized laboratory metrics. Future iterations are expected to integrate clinical-grade or socially-driven metrics, reflecting both dermo-cosmetic trends and the influence of digital advocacy. However, significant structural challenges persist, specifically concerning **Artificial Intelligence (AI)** integration, algorithmic interpretation, and GDPR compliance. Furthermore, addressing ethnicity-related biases is critical; research indicates that diagnostic accuracy can vary by up to 15-20% across different phototypes if **algorithms are not trained on diverse datasets.** Other hurdles include hardware reliability, connectivity, ergonomics, and long-term robustness.

The future of cosmetic science is defined by two trajectories: **the deployment of smartphone-based spectroscopy** and the **domestic adaptation** of medical technologies. These tools utilize probes, patches, or swabbing to facilitate high-throughput omics analysis, while connected mirrors envision holistic integumentary assessments. Within this ecosystem, CROs are vital for providing scientific validation, ensuring devices transcend mere novelty through expert guidance and AI interfaces. Furthermore, neurosensory modalities like **EEG complement traditional biomarkers**. Collectively, advancements in VOC analysis and microfluidics position real-time skin diagnostics as a proxy for systemic health, revealing previously inaccessible physiological mechanisms.

In conclusion, bringing biomolecules out of the body and into analysis is paramount for the next step in life science. The convergence of technological innovation and advanced biological inquiry is fundamentally restructuring dermo-cosmetic science. By integrating **high-throughput proteomic and lipidomic** profiling with non-invasive sampling, such as microfluidics, tape-stripping, and spectroscopy, the industry has transitioned from descriptive observation to a mechanistic elucidation of cutaneous biology. These advancements enable real-time, laboratory-grade measurements, facilitating skincare solutions precisely calibrated to an individual's biological signature and environmental exposome. Despite this progress, the field remains at a **critical inflection point.** While superficial sampling effectively quantifies hydration, inflammation, and microbiota balance, capturing deeper dermal structural biomarkers non-invasively persists as a technical challenge. Emerging frontiers, including **Volatile Organic Compound (VOC)** sensing, organ-on-chip platforms, and neurosensory monitoring, promise to expand this horizon by linking cutaneous changes to systemic physiology.

To ensure these tools transcend mere novelty, rigorous validation by Contract Research Organizations (CROs) and ethical AI-driven interpretation are indispensable. Ultimately, the future of beauty science lies in harmonizing miniaturized, high-resolution analytics with consumer-centric usability. As the biomarker library expands, the skin serves as a definitive diagnostic interface for holistic health, positioning dermo-cosmetics at the vanguard of precision wellness and personalized medicine.

The collective integration of these innovations delineates a singular trajectory: that of **predictive, quantifiable, and connected beauty.** In this paradigm, beauty emerges as an autonomous field of technological innovation, where scientific precision, user experience, and tangible efficacy supersede generic claims. For brands and consumers alike, this new era facilitates a more intelligent, responsible, and personalized relationship with cutaneous health.

Anne Charpentier, - Founder of Skinobs

References : see on the Cosmetics Testing News

From systemic interactions to nanoscale precision: new biological frontiers in skin longevity and resilience

Abstract

The 2 days of the Symposium showed that the cosmetic testing science is currently undergoing a major transition, moving beyond surface-level treatments toward a holistic understanding of systemic skin health. By integrating high-resolution technologies like Atomic Force Microscopy (AFM) and quantitative proteomics with the power of Artificial Intelligence, researchers can now decode the complex dialogue between skin compartments. This synthesis explores the latest scientific frontiers: the endocrine role of the hypodermis, the biomechanical identity of the stem cell niche, and the groundbreaking use of microbiome diversity as a biomarker for longevity. Together, these innovations redefine skin resilience in the face of the exposome.

Keywords

Exposome, Longevity, Microbiome, A.I., QSARmodels, Testing Science

SKINOBS

SOCIÉTÉ FRANÇAISE DE COSMÉTOLOGIE

Keynote focused on testing: International Symposium SFC

Pigmentation and Melanocyte Regulation: Beyond Surface Color

Innovation in pigmentation research is currently focused on **3D reconstruction** of the basal layer. Mizutani's team identified an exceptionally efficient melanosome transfer mechanism specific to age spots with a specific melanin accumulation. Research by Yuki Mizutani, Ph.D.et al. (KOSE) addresses solar lentigo, a hyperpigmented disorder resulting from **chronic UV exposure**. When keratinocytes are exposed to UV, they secrete biochemical signals that trigger melanin production in melanocytes as a defense mechanism. However, the accumulation leads to visible «age spots.» A significant discovery highlights the role of the dermis in pigmentation; researchers identified a novel anti-hyperpigmentation factor associated with the **senescence of dermal fibroblasts**. This suggests that achieving an even skin tone requires targeting not just the epidermis, but the regulatory signals originating from aged dermal cells.

Bioengineering and Predictive Models: The Organoid Return

The move toward more **ethical and predictive testing** is spearheaded by Human Skin Organoids and vascularized ex vivo models. Cécile NAIT et al. (BIOHIVE) emphasizes that organoids generated from **pluripotent stem cells** reproduce complex features, dermis, epidermis, hair follicles, sebaceous glands, and sensitive neurons, offering an alternative to animal testing. Dani

et al. (EXADEX) has developed 3D vascularized ex vivo models that preserve **native extracellular matrix** (ECM) and **lymphatic networks**. Their research reveals that abdominal and facial tissues have distinct metabolic and protein secretion profiles.

The Digital Transformation: AI and Microbiome Longevity

Artificial Intelligence is no longer a peripheral tool but the «cornerstone» of ingredient discovery and microbiome analysis. Coralie Ebert, PhDet al. (MeNow) utilize deep Bayesian networks and QSAR models to accelerate the **identification of novel bioactives**, such as SIRT1 activators and heparanase inhibitors. This increases the speed, specificity, and safety of the discovery process. Beyond mere speed, the integration of AI enhances the **safety, specificity, and sustainability** of new ingredients. By utilizing these predictive methodologies, the industry can move toward a «cleaner and smarter» innovation model. Ultimately, AI-driven discovery ensures more effective ingredient pipelines, bridging the gap between complex biological data and next-generation skincare solutions.

Systemic Skin Health: The Adipose-Dermal Axis and SIM Functions

The final frontier of skin innovation lies in the cross-talk between the hypodermis and the upper layers. Gallic Beauchef et al. (LVMH) research highlights that **White Adipose Tissue** (WAT) is a dynamic endocrine organ. Adipocytes

secrete adiponectin, which regulates the dermal ECM. Aging impairs this secretory profile and reduces the expression of adiponectin receptors in fibroblasts, disrupting the adipose-dermal interaction and contributing to structural skin decline.

Morover, the RESTORE Research Center evaluated fibroblasts from 133 individuals based on their ability to maintain tissue Structure, modulate Immune responses, and regulate Metabolism (SIM). The study found that fibroblast performance correlates with **«Intrinsic Capacity»** (IC) rather than just chronological age. Fibroblasts from frail individuals show reduced mitochondrial respiration and lower Periostin levels. Periostin serves as a cellular «health memory,» capturing the functional status of the individual regardless of age or sex.

Two lectures around the **Atomic Force Microscopy AFM** define this technology as a robust tool for detecting early biomechanical and topographical alterations. By mapping both the nanoscale surface descriptors of the stratum corneum and the **mechanical stiffness of stem cell niches**, researchers can more accurately predict product efficacy and develop strategies to preserve skin resilience against environmental stressors.

Advanced biophysical assessment using **Atomic Force Microscopy (AFM)** provides a precise window into skin health by quantifying nanoscale descriptors. Loretta utilizes AFM to characterize corneocyte topography, identifying Circular Nano Objects (CNOs) as key biomarkers for barrier integrity. Their research reveals that while psychological stress increases CNO density—reflecting depleted Natural Moisturizing Factor (NMF)—targeted cosmetic treatments effectively restore nanoscale homogeneity and barrier cohesion.

Parallelly, BIOMECA explores the **mechanical identity of the epidermal stem cell niche.** Their findings demonstrate that young interfollicular stem cells (ISCs) are 1.4-fold stiffer than neighboring keratinocytes. However, aging and exposome exposure (UV, pollution) trigger a «mechanical decline,» where ISC stiffness diminishes

and dermal papillae flattens. These biomechanical alterations emerge before visible clinical signs of aging.

Together, these studies prove that AFM-based descriptors serve as powerful cell-level biomarkers to evaluate **skin recovery and regenerative vitality** under real-life conditions.

Integrating Functional Proteomics and AI-Driven Microbiome Profiling

Two methodologies bridge the gap between microbial ecosystem dynamics and host protein expression. The synergy between **Phylogene's functional proteomics** and **HelloBiome's AI-microbiome** profiling offers a comprehensive, scientifically grounded framework for personalized cosmetic innovation, enabling a more predictive and inclusive evaluation of product performance under real-life conditions.

The convergence of **high-throughput multi-omics and artificial intelligence** is revolutionizing the evaluation of skin and scalp health. Phylogene employs **quantitative shotgun proteomics** (LC-HRMS) to decode the biological response of hair follicles to topical treatments. By identifying 4,008 proteins and performing bioinformatic enrichment analysis, they demonstrated that anti-hair loss products significantly modulate 389 proteins across multiple biological pathways (GO terms), providing a molecular signature for hair vitality and treatment efficacy.

Complementing this host-centric approach, HelloBiome leverages large-scale clinical data collection and AI-driven modeling to analyze the skin

and scalp microbiome. By integrating both bacterial and fungal insights, their deep learning models generate actionable scores for sensitivity, balance, and longevity. A critical outcome of this research is the identification of microbiome diversity as a **robust biomarker for aging and long-term tissue health.**

Conclusion: A Multi-Parametric Future

The research synthesized from SFC demonstrates that the future of cosmetic innovation is **multi-parametric and inclusive.** By combining the mechanical precision of AFM, the chemical depth of Shotgun Proteomics, and the predictive intelligence of AI, the industry can move toward **«well-aging»** strategies that are scientifically grounded.

The identification of early biomarkers, whether they are CNOs on a corneocyte, ISC stiffness in a dermal papilla, or adiponectin levels in the hypodermis, allows for personalized interventions that target the root causes of skin deterioration before they manifest clinically. This holistic approach, supported by 3D vascularized models and organoids, ensures that efficacy and safety are assessed on **models that truly reflect the diversity and complexity of human biology.**

Anne Charpentier,
Founder of Skinobs

INTERNATIONAL SYMPOSIUM
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cosmetotest

2026: 5th edition in Lyon and remote

Discover the latest scientific breakthroughs and evaluation methodologies for skin, scalp, and hair.

Following the resounding success of its first four editions, which most recently gathered over 230 participants from across the globe, the International Cosmetotest Symposium is returning to Lyon. Scheduled for March 18-19, 2026, in Lyon and in a digital format, this event remains only dedicated to the preclinical and clinical testing for cosmetics.

Anne Charpentier, Cosmetotest has become a landmark event. What is the vision behind this 2026 edition?
A.C.: «Cosmetotest has truly found its place in the international ecosystem of cosmetic performance evaluation. My vision has always been to create a specialized 'hub' where science meets industry. In 2026, we are continuing this mission by offering a panoramic view of the sector. What I appreciate most is the intensity and conviviality of these two days; it's a unique opportunity for professionals from Europe, Asia, and beyond to deep-dive into the themes that are currently at the heart of global evaluation.»

The symposium is famous for its «360-degree» approach. Can you describe the technological ecosystem participants will find in Lyon?
A.C.: «It is much more than a series of lectures. It is a complete scientific and technological ecosystem. This year, we are hosting over 30 exhibitors, bringing together the most influential names in the testing world. This allows participants to see, touch, and test the innovations of tomorrow.»

• Testing Partners (CROs):
Industry giants and specialists such as *Biomeca, Biomnigene, Byome Labs,*

Cliantha Research, DWI Labs, Goya Innova, Eurofins, Inovapotek, J.S. Hamilton, Loretta Biotech, Molecularis, OloBion, PKDerm, PHD Trials, Qima, SGS proderm, Sequential, Ten Bio, Vaiomer, Vibiosphen and Zurko Research will be present to showcase the latest in-vitro, ex-vivo, and in-vivo solutions.

• Instrumentation Manufacturers:
Leading innovators like *Ascilion, Canfield, Cortex, Damae Medical, Delfin, Eotech, Miravex, Monaderm, Orion Concept Technolab, Pixience, Qima, RiverD, Scibase* will perform live demonstrations of cutting-edge measurement devices.

Could you reveal the four scientific pillars that will define the 2026 program?
A.C.: «Every year, we select four new themes addressed through academic lectures, technological presentations, and 'short-talks' from our exhibitors. For 2026, we have a very strong lineup.
On Wednesday, March 18, we will open with:
• Session 1: The Exposome, evaluating impacts on skin and hair with **Anne Sirvent** - Eurofins, **Maya Naboulsi** - Clarins, **Dr. Simran Sethi** - Cliantha Research, **Philippe Papadimitriou** - Cosystems, **Elodie Prestat-Marquis** – Naos.
• Session 2: Hormones, measuring their influence on cutaneous and capillary physiology, with **Sébastien Grégoire**, **Juliette Sage** – LVMH Research, **Abdel Aouacheria** – CNRS, **Salvatore Del Prete** – Service Biotech, **Edouard Macé** – Eotech.
On Thursday, March 19:
• Session 3: Hydration, with **Hassan Zahouani** – LTDS, **Lieve Declerc** – Proya, and a new roundtable of experts dedicated to the session.
• Session 4: Skin & Brain, with **Dr. Haykal**, **Mathilde de Torsiac** – Sisley, **Eloïse Appelmans Gerardin** – Brain Impact Science, **Edith Filaire** – ICARE, **Axel de Marles** – Senseva, **Magalie Cabannes** – Greentech.
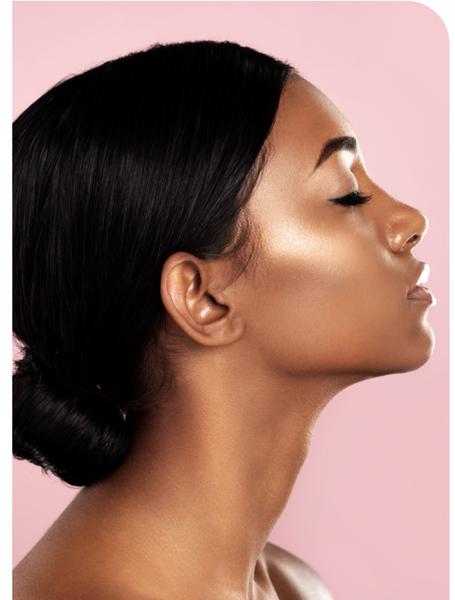
Why should an R&D or Evaluation Manager prioritize Cosmetotest 2026 in their calendar?
A.C.: «Because it is the only place where you can get a comprehensive update on both preclinical and clinical advancements in just 48 hours. Whether you are a brand looking for new claims, an ingredient supplier validating an active, or a researcher, the networking here is unparalleled. It is about fostering partnerships that move the entire industry toward safer, more effective, and more innovative products.»
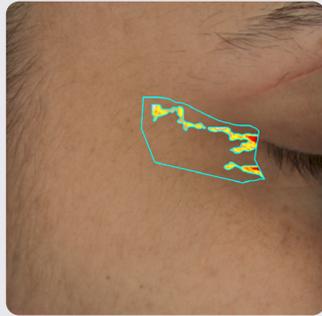
www.cosmetotest.skinobs.com
cosmetotest@skinobs.com

Antera 3D® CS

Advanced Skin Imaging for Efficacy Claims Substantiation
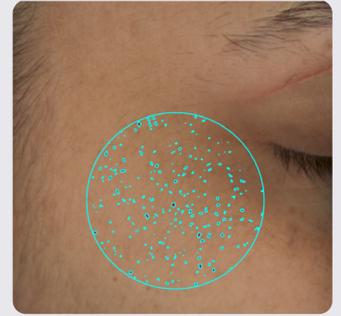
Wrinkles Claims

- Crow's feet
- Fine lines
- Forehead wrinkles
- Lifting
- Marionette lines
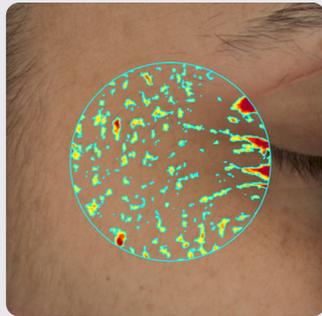- Nasolabial folds
- Anti-wrinkles

Pores Claims

- Deep cleansing
- Enlarged pores
- Pore Tightening
- Small pores

Volume Claims

- Anti-acne prone skin
- Anti-cellulite
- Anti-cracks (skin/lips)
- Anti-sagging
- Anti-stretch marks
- Comedolytic
- Eye bags
- Resculpting
- Restructuring
- Scars
- Wound healing effect

Texture Claims

- Anti-ageing
- Anti-blemishes
- Anti-cellulite
- Anti-cracks (skin/lips)
- Anti-dryness
- Anti-stretch marks
- Comedolytic
- Exfoliating
- Firming/lifting
- Healthy skin
- Keratolytic
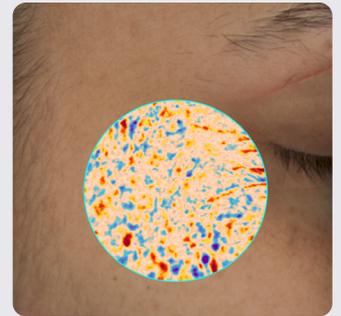
Redness Claims

- Acne-related erythema
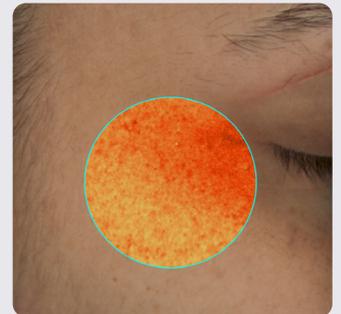- Anti-couperose
- Anti-inflammatory
- Anti-redness/rosacea
- Erythema
- Irritant potential
- Skin prone to acne
- Wound healing effect
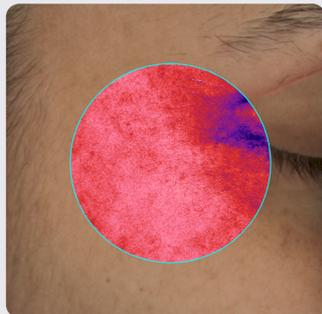
Pigmentation Claims

- Anti-brown spots
- Anti-dark circles
- Anti-melasma
- Anti-sun damage
- Depigmenting
- Hyperpigmentation
- Lightening
- Tan activator
- Tan prolonging

miravex

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Stay tuned! Updates from testing labs

Byome Labs

With 20 years of expertise in microbiome analysis, we support cosmetic and pharmaceutical brands in the testing, characterization and scientific validation of microbiome-related claims. Our work covers multiple ecosystems, including cutaneous, oral, vaginal and scalp microbiomes. We assess both microbiome respect and the targeted rebalancing of dysbioses involved in conditions such as acne, atopic dermatitis or dandruff. Our studies generate robust, verified and verifiable scientific evidence, aligned with regulatory requirements and the expectations of regulatory authorities, to support reliable and substantiated product claims.

Cortex

DermaLab Aesthetic is an advanced skin analysis instrument designed to support aesthetic clinics in customer consultation and decision-making.By measuring five key skin parameters, it provides an objective and structured overview of the skin's current condition, presented through clear visualisations that are easy to understand for both professionals and customers. The analysis is completed within minutes and serves as a strong foundation for professional dialogue, targeted recommendations and a more transparent customer journey. DermaLab Aesthetic supports clinic growth by strengthening trust, improving conversion and creating clear links between analysis, services and home care.

Ellead

Cosmetics contain ingredients with effects such as skin moisturizing, whitening, anti-wrinkle. In order to maximize the efficacy of cosmetics, the absorption of active ingredients is very important. For several years, Ellead has accumulated optimal know-how while conducting an evaluation that non-invasively measures the depth and amount of skin absorption of the target material through the latest Raman spectroscopy (gen2-SCA, RiverD, Netherland), which is the ultimate version that can check the depth of up to 500μm in the skin. In addition, the change in NMF in the skin and the amount of water concentration can be measured through the library provided by the analysis tool.

Eotech

Eotech enriches its offer in in-vivo 3D imaging with a new software module. The Color Map 3D allows a visualization of a cutaneous parameter measured in a punctual manner at several location on the skin (Hydration, Shininess, TEW...). The client provides a 3D data file, measurement values on the considered area (face or body part) and selects a color scale. The module interpolates values from known measurements and generates a 3D skin map in false colors. This solution is currently offered as a service to customers already equipped with an Eotech scanner, enhancing the capabilities of exploitation and interpretation of data from 3D imaging.

Goya Innova

GOYA INNOVA offering an integrated CRO model and Medical & Aesthetics Center that enables efficient, controlled, and high-quality clinical research , providing a strong competitive advantage in the development of Clinical Investigations. This model allows access to a diverse and well-characterized participant population and medical specialties improving representativeness and external validity of study results, while ensuring optimized recruitment, high participant retention, and strong protocol compliance, resulting in more robust and reliable data. Through shared infrastructure, specialized staff, and streamlined operations, GOYA INNOVA optimizes resources, reduces operational costs, and accelerates time-to-market. This approach supports innovative and robust study designs, enables comprehensive evaluation of safety, efficacy, and additional product benefits, and generates high-quality, market-relevant clinical data that strengthens regulatory submissions and product positioning.
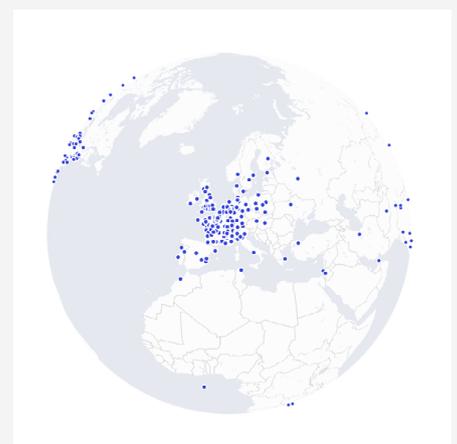
Miravex

The Antera 3D camera is a valuable in vivo imaging tool for objective assessment of photoaging in clinical research. Using multi-directional LED illumination and seven wavelengths, it generates high-resolution 3D skin images and performs multispectral analysis of epidermal and dermal chromophores. Antera 3D enables quantitative evaluation of key photoaging parameters, including wrinkle depth, surface texture, uneven pigmentation, vascular features, and pore size. Across multiple clinical studies, consistent improvements in wrinkles and pigmentation were reliably detected despite varying treatment protocols. Its rapid, reproducible, and non-invasive measurements make Antera 3D particularly useful for CROs in efficacy assessment, cosmetic trials, and longitudinal monitoring of surface-level photoaging changes.

NovoBliss Research

NovoBliss Research Pvt. Ltd., clinical research organization focused on generating scientifically rigorous, ethically sound, and regulatory-compliant evidence to support credible product claims. The designation "clinically proven" represents validation through a structured continuum of preclinical evaluations, well-designed randomized controlled trials, multicentric studies, and real-world evidence demonstrating safety, efficacy, and reproducibility. NovoBliss emphasizes standardized endpoints, adherence to Good Clinical Practice, and consideration of geographical, investigator, and environmental variability. Regulatory perspectives from CDSCO, FSSAI, USFDA, TGA, and EMA are incorporated to ensure authenticity and credibility, while emerging tools such as AI-assisted imaging and advanced instrumental analyses strengthen evidence reliability and consumer trust.

PhD Trials

PhD Trials® acquires Inovapotek and strengthens its position in cosmetic product testing. On the occasion of its 15th anniversary, PhD Trials® announced the acquisition of Inovapotek, the second largest cosmetic product testing company in Portugal, further strengthening its sustained growth strategy. The transaction is part of an expansion plan focused on strengthening teams, investing in infrastructure and technology, and continuously adapting to increasing scientific, regulatory, and market demands. With 18 years of experience, Inovapotek will maintain its management structure, led by Dra. Marta Ferreira. The integration will enable the creation of technical synergies and the expansion of PhD Trials®' offering in clinical studies and cosmetic product testing. This acquisition represents another step in PhD Trials®' commitment to sustainable growth, scientific excellence, ethics, independence, and a long-term international vision.

Syres

SYRES remains your trusted partner in consumer testing, advancing rigorous methodologies across expanding sectors. As France's leading specialist for over 30 years, we now support brands in Beauty & Personal Care, Health & Active Lifestyle, Food Supplements, and our newest division: Pet Care. Our collaborative, multidisciplinary team—statisticians, sensory analysts, medical and veterinary experts, behavioral specialists—works alongside you to validate products from active ingredients to finished formulas. We deliver dermatologist-controlled consumer trials, comparative studies versus placebo, and standardized photographic assessments for objective results. With qualified consumer panels and strong international presence, we're here to support your success across all markets!
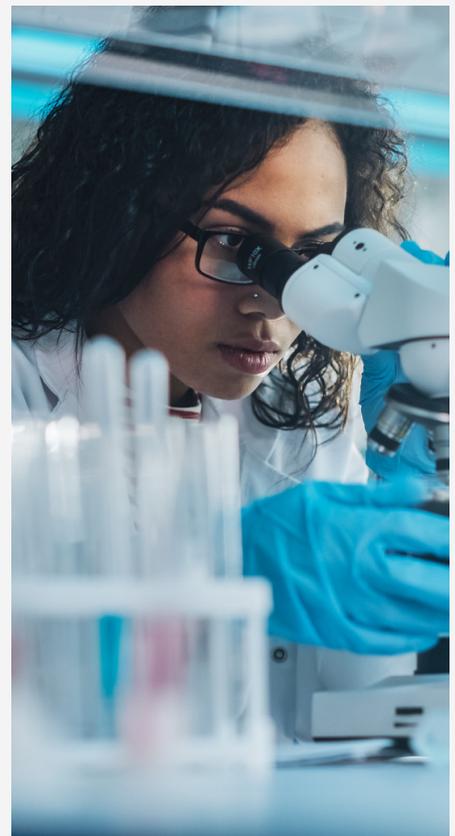
Validated Claim Support

Validated Claim Support has announced that it is the only clinical laboratory in the United States that is also approved by QVC and HSN as a marketing photography studio. This rare dual designation reflects the company's ability to meet rigorous scientific, regulatory, and commercial production standards within a single organization. By integrating accredited clinical research operations with broadcast-ready visual content creation, Validated Claim Support enables brands to generate substantiated product claims while simultaneously producing compliant, high-quality marketing imagery. This distinction reinforces the company's position as a trusted partner for consumer brands seeking credible science and marketplace-ready marketing assets under one validated framework.

Skinobs 2025 testing platform insights

As the cosmetic industry moves toward increasingly sophisticated substantiation, Skinobs' latest audience reports offer a deep dive into the testing priorities of 2025. From the rise of microbiome-friendly claims to the surge in clinical consultations, here is an analysis of the current landscape of cosmetic evaluation.

Clinical Evaluation: From Perception to Precision Biometrology

Clinical evaluation remains the ultimate benchmark for product validation, as evidenced by the high level of engagement on the Skinobs clinical platform. With 5,195 active users and a 15% growth in page consultations, totaling over **27,800 views**, the industry's search for human-based evidence has never been more intense.

A key takeaway from the 2025 report is the absolute dominance of biometrological analysis, which now represents **67% of all searches** by type of test. This trend signifies a move away from simple consumer perception towards objective, quantifiable data measured on skin, hair, and nails. While «**Hydration**» remains the most sought-after claim, the rise of «**Well-ageing**» and «**Skin barrier strengthening**» to the top of the rankings reflects a broader consumer demand for long-term skin health and protection rather than just immediate aesthetic correction.

Furthermore, the expansion of the clinical ecosystem, with the number of partners CROs projected to reach 349 in 2025, offers brands an **unprecedented diversity of expertise** to support their claims.

2025 Clinical claims
2024 datas

1. Hydration
   Hydration
2. Well-ageing
   Well-ageing
3. Skin barrier (strenghtening)
   Soothing
4. Anti-pollution
   Barrier function
5. Radiance
   Anti-pollution
6. Microbiome friendly
   Oxygenating
7. Non-irritating
   Smoothing
8. Repair
   Anti-oxidant

2025 Preclinical claims
2024 datas

1. Microbiome friendly
   Hydration
2. Well-ageing
   Well-ageing
3. Hydration
   Anti-oxydant
4. Anti-oxidant
   Anti-inflammatory
5. Skin barrier (strenghtening)
   Anti-hair loss
6. Microbiome friendly
   Radiance
7. Non-irritating
   Smoothing
8. Healing
   Anti-pollution

Preclinical Innovation: Decoding the Skin's Biological Ecosystem

The Skinobs preclinical platform has seen a 13% increase in user searches, highlighting a growing interest in understanding the underlying biological mechanisms of active ingredients.

The most striking trend in 2025 is the crowning of «**Microbiome-friendly**» as the number one preclinical claim, overtaking traditional categories like hydration and anti-oxidation. This shift confirms that the industry is now deeply invested in the «probiotic and prebiotic» approach to skin science. This biological focus is further supported by the types of tests being prioritized: efficacy tests on skin lead with **53% of searches**, followed by microbiology at 16%. To meet this demand for specialized knowledge, the network of partner laboratories has seen explosive growth, more than doubling from 204 in 2023 to an expected 470 in 2025. With nearly 240 distinct testing methods now available, R&D teams have more tools than ever to explore the complex interactions within the skin's ecosystem.

A Future Built on Substantiation

The data provided by Skinobs for 2025 highlights an industry that is becoming increasingly expert and demanding. The convergence of advanced biometrology in clinical trials and the rise of microbiome science in preclinical research suggests a future where beauty is synonymous with biological health. For brands, success in this new landscape will depend on their ability to navigate this **complex testing environment** and provide consumers with the high-level scientific substantiation they now expect.

MARKET INSIGHTS

Microbiota White Paper

Substantiating skin microbiome claims: from science to evaluation

01 The Rise of Claims Targeting the Skin Microbiota

Discover why the microbial balance of the skin and scalp is at the heart of cosmetic product development.

02 Science & Evaluation Designing Credible Microbiota Claims

Better distinguish between microbiota and microbiome, and understand the regulatory framework for claims concerning the skin microbiota.

03 Tools and Methods to Substantiate Microbiome Claims

Explore the full range of in-vitro, ex vivo, and in vivo evaluation methods, as well as classic or high tech analysis techniques.

DermaProof Asia®

EFFICACY AND SAFETY TESTS OF DERMO - COSMETICS

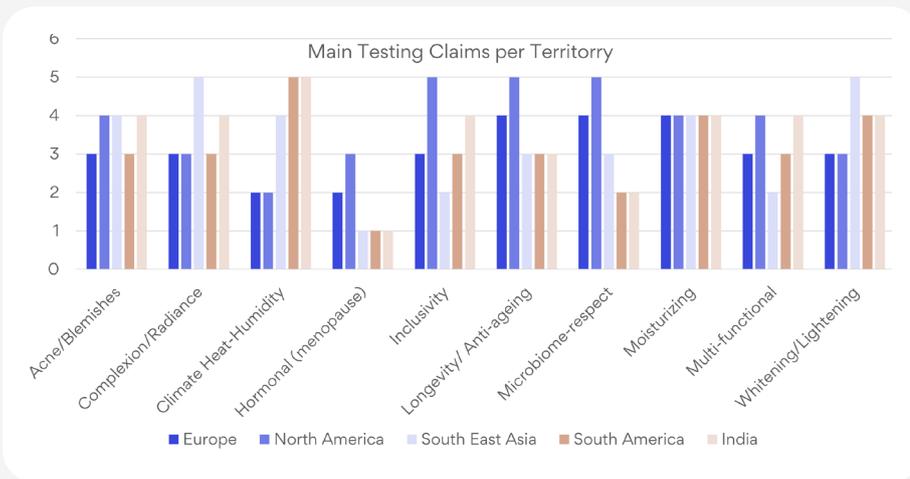## INDEPENDENT CLINICAL TRIAL CENTER IN THAILAND

PROFESSIONAL CLINICAL TRIAL CENTER

In-vivo evaluation of efficacy and safety of dermo-cosmetics in Asian subjects

2026 , The Global Cosmetic Testing Landscape: Regional Claims, AI, and Technologies

The Skinobs barometers serve as a unique strategic intelligence tool, synthesizing global trends within the cosmetic testing market. Each parameter, ranging from AI and Omics to eco-design, is assigned a score from 1 to 5, reflecting its actual influence on the sector. Each year, these scores are updated across key market drivers, allowing for a quantitative assessment of the impact of emerging technologies, product claims, and geographic dynamics.

These indices are far more than mere statistics; they are the result of qualitative analysis derived from continuous and international dialogue with consultants and R&D leaders across the ingredient and finished product industries. This strategic monitoring is further enriched by the review of recent publications, industry trade shows, and active participation in international scientific congresses. The result is an essential forward-looking dashboard for anticipating future standards in scientific substantiation.

Main Testing Claims per Territorry

Categories: Acne/Blemishes, Complexion/Radiance, Climate Heat-Humidity, Hormonal (menopause), Inclusivity, Longevity/ Anti-ageing, Microbiome-respect, Moisturizing, Multi-functional, Whitening/Lightening

Legend: ■ Europe ■ North America South East Asia ■ South America India
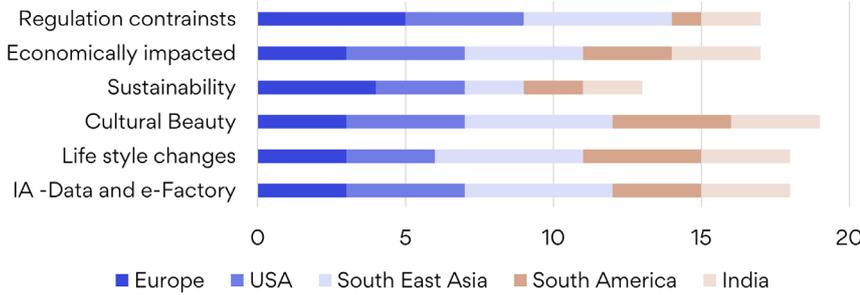
Global Overview of Product Claims

The market remains dominated by historical pillars, yet significant regional disparities are emerging:

• **Moisturizing** remains the most frequently tested claim globally, maintaining a balanced presence across all territories.

• **Whitening/Lightening** ranks second overall, driven extensively by India and Southeast Asia, whereas Europe and North America record the lowest scores in this segment.

• **Longevity and Anti-ageing** are paramount priorities in Europe and North America, while remaining significant priorities in Southeast Asia.

• **Inclusivity** demonstrates a marked leadership in North America, signaling more advanced maturity in these high-value niche segments.

• **Microbiome-respect**: North America leads this segment, closely followed by Europe.

MARKET INSIGHTS

Factors influencing the testing market

(Bar chart categories, top to bottom: Regulation contrainsts, Economically impacted, Sustainability, Cultural Beauty, Life style changes, IA -Data and e-Factory; x-axis 0 to 20)

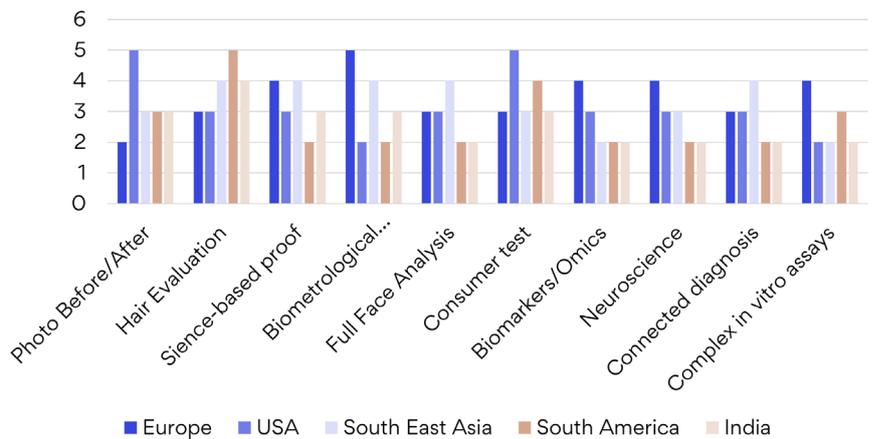Legend: Europe, USA, South East Asia, South America, India

Influencing Factors

• **Artificial Intelligence and Data** are cited as the primary global drivers. However, the data indicates that Asia and North America are the regions that place AI highest among their priorities.

• The **«Eco-design / Sustainability»** factor is very prominent in Europe and the USA, but is less frequently cited as a testing «driver» in Asia.

Evaluation Methodologies (Testing Science Routine)

The data reveals a technical specialization by continent:

• **Europe**: Champion of «Deep Science,» holding leadership in Biomarkers/Omics, Neuroscience, and complex in vitro assays. It also leads in biometrological measurements.

• **North America** relies heavily on visual evidence (Before/After photos) and subjective perception (Consumer tests), reflecting a marketing strategy focused on immediate proof and customer satisfaction.

• **South America**, specifically Brazil, largely dominates the «Hair care» segment, consistent with the region's historical expertise in hair fiber.

• **Southeast Asia**: Highly proficient in Connected Diagnostics and Full-Face Analysis.

Testing science routine

(Bar chart; y-axis 0 to 6; categories: Photo Before/After, Hair Evaluation, Sience-based proof, Biometrological..., Full Face Analysis, Consumer test, Biomarkers/Omics, Neuroscience, Connected diagnosis, Complex in vitro assays)

Legend: Europe, USA, South East Asia, South America, India

The Skinobs barometers serve as a unique strategic intelligence tool, synthesizing global trends within the cosmetic testing market.

MARKET INSIGHTS

The French Cosmetics Market: High-Tech Efficacy and Clean Beauty

in-cosmetics® global

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14-16 April 2026**

In 2026, the French cosmetic landscape continues to be a global beacon for clinical rigor. While the U.S. market focuses on regulatory Catch-up (MoCRA), the French industry is doubling down on Scientific Sophistication and Environmental Transparency. With a domestic market projected to reach €15 billion in 2026 and a 7% CAGR, France is leading the transition from traditional dermo-cosmetics to «Biotech-driven» clinical evaluation.

The Ban on PFAS and the «Clean Analysis» Surge

As of January 1, 2026, the French government has implemented a strict ban on **PFAS (per- and polyfluoroalkyl substances)** in cosmetic products. This has triggered a massive wave of reformulation and, consequently, a surge in analytical testing. French laboratories are now operating at full capacity to perform high-sensitivity screenings for «forever chemicals.» Beyond mere compliance, the «Clean Beauty» movement in France has evolved into «Verifiable Beauty». Brands no longer simply claim to be eco-friendly; they must provide full life-cycle assessments (LCA) and traceability data, leading to a 13% increase in patent filings related to green chemistry and biotechnological extraction methods.

The Microbiome & Exosome Frontier

France remains one of the epicenter of **skin microbiome research**. In 2026, the conversation has shifted from «microbiome-friendly» to «Functional Microbiome Regeneration.» Clinical testing protocols now routinely incorporate 16S rRNA sequencing to prove that a product doesn't just preserve, but actively restores the skin's biological ecosystem. A breakthrough trend for 2026 is the clinical focus on Exosomes. These nano-vesicles are the new stars of regenerative medicine applied to cosmetics. French clinical trials are increasingly utilizing **advanced imaging**, such as Multiphoton Microscopy, to visualize the penetration and signaling efficacy of exosome-based formulas in deep skin layers, aiming to prove real-world cellular rejuvenation.

Neurocosmetics and the «Self-Sovereignty» Trend

Following the innovations seen at CES 2026, the French market is witnessing a rise in Neurocosmetics, products designed to influence the **skin-brain axis**. In a world characterized by «biological sovereignty,» French consumers want to control their physiological response to stress. Testing centers have adapted by integrating Sensory Evaluation 3.0. Protocols now combine traditional clinical measurements (like TEWL for barrier function) with **neuro-scientific tools**: heart rate variability (HRV), galvanic skin response, and even AI-driven facial emotion analysis. The goal is to quantify the «well-being» effect of a texture or a scent with the same precision as a wrinkle reduction claim.

Digital Twins and the Democratization of Efficacy

France is also a leader in New Approach Methodologies (NAMs). To maintain a competitive edge while respecting ethical constraints, the use of In Silico skin modeling has become standard practice in the pre-clinical phase. French labs are increasingly using «Digital Twins» of different skin phototypes to predict irritation or efficacy before a single drop of product touches human skin. This predictive medicine approach has reduced the time-to-market for innovative active ingredients by nearly 25%, allowing French companies to remain the most agile players on the global stage.

For the scientific community, 2026 marks the year where «Made in France» becomes synonymous with «Proven in France.» Between the strict enforcement of **European Green Deal regulations** and the rise of ultra-sophisticated clinical tools, the French market is no longer just selling luxury; it is selling **quantifiable biological transformation.**
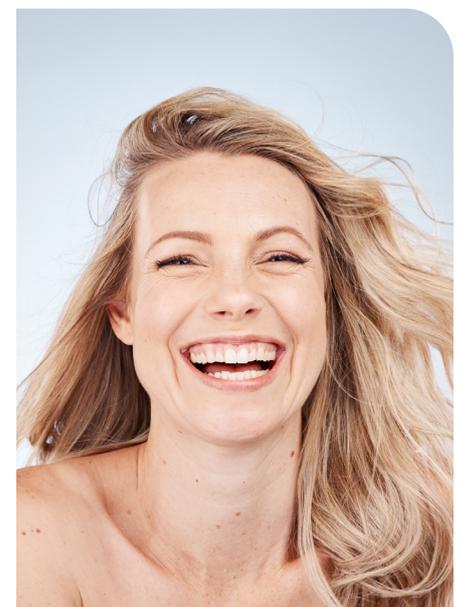
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SCALP CARE

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Wed, 15th Apr. 15:05 - 15:35. Theatre 3, Hall 7, Level 3.
Trichoscopy: A Key Tool for Understanding and Assessing Hair Aging.

info@zurkoresearch.com   www.zurkoresearch.com

Sequential
Bringing Credibility Back to Personal Care Claims

www.sequential.bio

As personal care claims grow more complex, from **microbiome balance** to barrier repair and inflammation support, evidence often struggles to keep pace. Too many products rely on limited in vitro models or perception data that fail to reflect real biological impact.

Sequential is helping bring credibility back to claims through **robust, clinically structured multi-omics research.** By combining next-generation sequencing with advanced molecular profiling, we generate systems-level insights into how products truly perform. **Our user-friendly, non-invasive patch** enables standardized sample collection under real-world conditions, making **high-quality biological data** scalable and accessible. The result: defensible claims grounded in **meaningful, reproducible science**, not marketing noise.

MyMicrobiome
Certification mark for Microbiome-friendly cosmetic products

www.mymicrobiome.info/en/welcome

MyMicrobiome is the global leader offering the only registered certification mark for Microbiome-friendly cosmetic products & ingredients, hygienic products, and pet care.

It turns science into trust & differenciation! The Microbiome-friendly certification provides brands with **verifiable claim security,** reducing regulatory and reputational risk by an independent certification body. More than 170 global brands and ingredient suppliers like BASF, BEEKMAN 1802, Börlind, Burt´s Bees, Cargill, Codex,

Dow, DSM, Dr. Reddy´s, Henkel, Innersense, Normactive, Nutrafol, Sasta Skin Health, Stepan, Tri-K, True Botanicals and many more trust the seal, which is registered in 40 countries worldwide. Our Microbiome-friendly standards cover areas for the **face, body, scalp, vagina, vulvo-vagina, oral, nasal, acne-prone, and eczema-prone skin microbiome for adults and infants**, ensuring scientifically validated and safe products for a better, microbiome-friendly world.

Zurko Research
Environmental pollution is one of the hair's most underestimated aggressors

www.zurkoresearch.com/

At Zurko, we help brands scientifically demonstrate how their products protect, restore and defend **hair against pollution-related damage.** Urban pollution weakens hair fiber and scalp over time, impacting both hair health and appearance. Through tailored efficacy studies, the following **key pollution-induced damages** can be evaluated and transformed into strong, consumer-relevant claims:

• **Cuticle damage & increased porosity**
Pollution particles weaken the cuticle and compromising its natural protective barrier.
• **Loss of shine & dull appearance**
Deposits reduce light reflection, leaving hair looking flat and opaque.
• **Dehydration & roughness**
Oxidative damage degrades essential lipids, increasing water loss and leaving hair dry, brittle and less flexible.
• **Scalp discomfort & irritation**
Environmental stressors may disrupt scalp balance, leading to reduced sensation of comfort.
These effects can be demonstrated using a combination of advanced instrumental techniques, **dermatological evaluation, and sensorial assessment,** providing robust scientific support for anti-pollution, protective and detox haircare claims.

PhD Trials
15 Years of Excellence: How PhD Trials is Redefining Clinical Substantiation through Advanced Biometrological R&D

www.phdtrials.com/
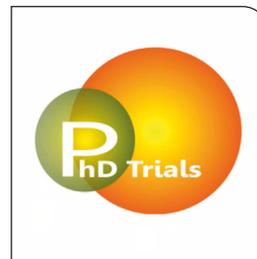
With a new center exclusively dedicated to R&D projects, PhD Trials, which has recently celebrated its 15th anniversary, has established itself as a leading innovator in the field of biometrological evaluation of dermocosmetics and raw materials products performance. Based in Lisbon, this CRO distinguishes itself through an approach where R&D serves scientific substantiation. This testing laboratory, renowned for its protocol designs, also excels in **developing innovative methodologies to quantify and visualize the complex interactions** between a beauty routine and its impact on the skin.

Their **innovation hub** relies on a state-of-the-art instrumental fleet, including Raman spectroscopy, confocal microscopy, high-resolution imaging VISIA-CR, AEVA-HE, and Laser Doppler, among other advanced systems. These tools enable the conversion of theoretical concepts into quantifiable data, particularly for claims related to **anti-aging, pigmentation, senescence or microcirculation.** Beyond instrumentation, the strength of PhD Trials lies in their intellectual capital, featuring a multidisciplinary team that actively participates in global scientific congresses. This expertise allows them to provide **bespoke protocols,** thereby ensuring that product innovation remains firmly rooted in rigorous and avant-garde clinical validation.

IMASENS
Marketing & Sensory Research

Multiple levels of intervention to capture **relevant insights and diagnose innovations**

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- **Home** Use Test
- **Central location** Test
- **Online** Community

SENSORY ANALYSIS

- Internal **experts panels**
- **Static & Dynamic** profiles
- **Olfactive** kinetics
- **Controlled wear** test

INNOVATION AREA

- Innovative **image analysis**
- Assessment by **esthetician/hairdresser**
- **Clinical scoring** by trained experts

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The American Cosmetics: Science-Backed & Regulatory Frontier

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19-20 May 2026

The U.S. cosmetic market in 2026 is no longer defined by marketing «storytelling» alone. We are entering the era of Clinical Evidence 2.0. Driven by the full enforcement of the **Modernization of Cosmetics Regulation Act** (MoCRA) and a consumer base that prioritizes efficacy over brand loyalty, the industry is witnessing a profound transformation in how products are tested, validated, and brought to market

The MoCRA Effect: From Awareness to Active Enforcement

As of 2026, the «grace period» for U.S. cosmetic compliance has ended. The FDA has transitioned into an active oversight phase, with a particular focus on Safety Substantiation. Every marketed formula must now be backed by a Product Safety Substantiation Dossier. This regulatory shift has fundamentally changed the laboratory landscape, leading to a 15% increase in demand for **in vitro toxicology and microbial challenge testing** compared to 2024. Furthermore, standardized testing is now the baseline; with the finalized methods for asbestos detection in talc and the strict «Fragrance Allergen Disclosure» rules, analytical testing has become a mandatory hurdle for any brand seeking shelf space in the American market.

Clinical Testing Trends: Beyond the Surface

The U.S. beauty market, projected to exceed $200 billion in 2026, is pivoting toward «Skin Health» rather than «Beauty.» This shift is reflected in the **sophistication of clinical claims.** The microbiome skincare segment, for instance, has matured into a $0.5 billion market, where testing protocols have moved beyond simple «microbiome-friendly» certifications to complex functional assessments. These now utilize high-throughput sequencing and bio-informatics to provide objective proof of ecological balance. Simultaneously, we are seeing the rise of Longevity Science. Influenced by the bio-hacking movement, **American consumers demand proof of cellular health**. Clinical trials now frequently integrate biomarkers for senescence, mitochondrial function, and collagen fragmentation, moving the evaluation process from the epidermis deep into the cellular matrix.

The Digital Revolution: In Silico and Beyond

The rising complexity of human clinical trials, with costs often exceeding $100,000 for comprehensive studies, has accelerated the adoption of New Approach Methodologies (NAMs). We are witnessing a strategic integration of In Silico modeling, where molecular docking and predictive toxicology are used to reduce the preclinical phase by up to 30%. This is complemented by the widespread use of **3D Bioprinted Skin models.** These substrates allow for highly reproducible efficacy testing against environmental stressors like pollution and specific UV spectrums, providing an ethical and scientifically robust alternative to traditional methods. On the consumer side, AI-driven skin analyzers have created a massive stream of real-world data, allowing brands to monitor product performance through continuous «post-market» evaluation.

Precision Beauty and the «Testing of One»

The «one-size-fits-all» model is being replaced by Precision Healthcare principles. The Next-Generation Personalized Beauty market is growing at a CAGR of 15.3%, reaching an estimated $55.98 billion in 2026. This requires a new testing paradigm focused on individuality. We are seeing a surge in protocols designed for at-home diagnostic kits and DNA-based customization. Testing facilities are no longer just evaluating a formula's impact on a broad population; they are developing the algorithms and validation sets that allow formulas to adapt to an individual's specific genetic profile and environmental exposure. For the Skinobs community, the 2026 U.S. landscape represents an unprecedented opportunity. **The marriage of stricter regulatory oversight and high-tech consumer expectations** has made rigorous clinical and preclinical evaluation the absolute cornerstone of the industry. Success in the American market now belongs to those who can quantify the invisible and prove that beauty is, indeed, a science.
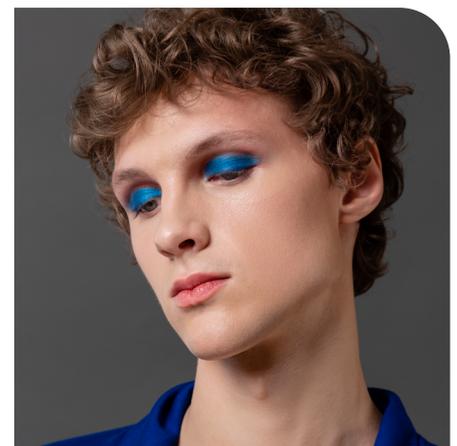
The Essential Event for the American Beauty Industry

NYSCC Suppliers' Day is the place where testing science meets formulation, allowing brands to discover the latest methods to prove the safety and performance of their products.

Here is an expanded version of the text for your presence at NYSCC Suppliers' Day:

Discover the «We Are Testing» Collaborative Hub at NYSCC Suppliers' Day 2026.

Skinobs is proud to return to New York with its signature «We Are Testing» collaborative booth, a unique concept designed to bring clarity and expertise to the complex world of cosmetic evaluation. Under the leadership of CEO Anne Charpentier, this hub serves as a strategic meeting point for brands looking to validate their product claims in the highly competitive US market. As the beauty industry shifts toward precision science, having a dedicated space to discuss both preclinical and clinical testing is essential for transforming innovative formulations into proven, market-ready successes.

This year, the «We Are Testing» booth gathers a prestigious group of co-exhibitors, each bringing a specific scientific edge to the table. Visitors can meet with the experts from **CIDP** to discuss global clinical research strategies, explore the frontiers of rapid microbiome analysis and biological diagnostics with **Byome Labs**, or discover **Scibase's** pioneering non-invasive technologies for assessing the skin barrier. This high-level technical synergy is further strengthened by the support of our sponsors, **Loretta** and **Weneos**, who share our commitment to scientific transparency and excellence.

We invite you to join us to explore the latest methodologies that are shaping the future of beauty. Whether you are focused on demonstrating long-term efficacy, ensuring safety, or exploring the new **«multipolar» innovation trends of 2026,** our team and partners are here to provide tailored guidance. NYSCC Suppliers' Day is the perfect venue to connect formulation with the testing science that proves its performance, and the «We Are Testing» booth is your primary gateway to this essential expertise.

SKINOBS

EVENTS

Skinobs 10th Anniversary

From a visionary idea to the world's leading cosmetic testing ecosystem

A little over ten years ago, an American friend of Anne Charpentier was desperately searching for a laboratory in Southeast Asia to conduct an innovative anti-aging study. It took nearly eight days of searching to identify the right partner. Faced with this lack of reliable, centralized information on cosmetic testing and claims, the idea for Skinobs was born. Today, we are proud to celebrate our 10th anniversary, marking a decade-long journey that began in Aix-les-Bains. Skinobs was built brick by brick, grown with patience and sincerity to become an independent, neutral hub connecting cosmetic brands with testing laboratories across the globe.

Our mission has always been to simplify access to testing to optimize your product development. This journey reached a major milestone in April 2016 with the official launch of the clinical platform at in-cosmetics Paris, starting with 25 laboratories and approximately 50 methods. That same year, we launched our flagship publication, ZOOM #1. By 2020, even amidst the challenges of a global pandemic, we doubled our scope by launching the preclinical platform for in-vitro and ex-vivo testing. The ecosystem continued to expand in 2022 with the birth of Cosmetotest in Lyon, an international symposium that brought together 250 participants for its first edition. In 2023, Skinobs began its global expansion with «We Are Testing,» an innovative collaborative stand concept first introduced at the NYSCC Supplier's Day in New York. This momentum led to the 2024 launch of Skinobs 2.0, our most significant technical overhaul, which unified our clinical and preclinical platforms into a single interface featuring integrated messaging and project management tools. Most recently, in July 2025, we completely redesigned the Cosmetics Testing News (CTN) with a new visual identity and a thematic filtering system to better serve our community.

What began as Anne working alone has evolved into a dedicated team of eight people supporting a vast international network. Today, Skinobs references over 1,500 methods and 500 laboratories, serving more than 8,000 registered experts across 25 countries. Our newsletter now reaches 7,000 subscribers with an engagement rate well above industry averages, and we are supported by over 80 paying partner laboratories. We are deeply grateful for the trust you have placed in us over the last ten years, and we look forward to celebrating this anniversary together during the 5th edition of Cosmetotest on March 18-19, 2026, in Lyon.

DIRECTORY OF COMPANIES LISTED

SKINOBS

Upcoming events

Meet the team around the world in 2025 and 2026, to exchange about your preclinical and clinical testing projects.

cosmetotest	March **18-19**
in-cosmetics® global	April **14-16**
NEW YORK Society of Cosmetic CHEMISTS	May **19-20**

skinobs

skinobs

10th
anniversary

We've only been talking about cosmetics *testing with you !*

PLATFORM

The Global Testing Database

500+ labs
200+ claims
1 500+ methods

EVENTS

The Place for Testing Experts

We Are Testing®
Cosmetotest
Boost Your Test

RESOURCES

The News Feed

Cosmetics Testing News
ZOOM
FOCUS

We are not a lab.
We are not A.I.
Connect for **free**