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Speaker Abstracts

Session E: Emerging Technologies

From Gut to Skin: A Postbiotic Approach to Improve Skin Condition and Holistic Well-being

Alba CICO, PhD; CRODA

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In modern life, stress and cortisol release are unavoidable. Cortisol weakens skin by: disrupting the barrier, triggering inflammation, and accelerating aging, which in turn affects psychological well-being. Since gut microbiota helps reduce stress-related symptoms and improves epithelial barrier, we explored whether a gut-derived *Lactobacillus* postbiotic could help transform the skin into an anti-stress barrier.

In vitro, cortisol disrupted skin barrier and suppressed keratinocyte circadian rhythm by abolishing CRY2 expression. The postbiotic reversed these effects: it increased expression of barrier markers, restored CRY2 rhythmicity and enhanced melatonin production. In addition, the postbiotic boosted both expression of longevity markers (NAD+, Sirt1) and local well-being signaling (β-endorphin, dopamine, oxytocin).

Clinically, skin regeneration and resilience to facial expression improved significantly. Sleep quality, assessed via ballistography, showed measurable enhancement. Well-being parameters were elevated while stress reduced.

Overall, better skin condition promotes self-esteem, confidence, sleep, and well-being creating a virtuous cycle between skin and emotional health.

Single-Cell Transcriptomics Unveil Cellular States of Reconstructed Human Skin Models Mimicking Human Explants

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Reconstructed human skin models are pivotal for dermatological and cosmetic research, yet their complexity remains poorly underexplored at single-cell resolution. In this study, we applied single-cell RNA sequencing (scRNA-seq) to two 3D skin models—a fibroblast-supported human skin equivalent (FibHSE) and a pigmented human epidermal equivalent (PmtHEE)—and compared them with native neonatal foreskin epidermis (FsEpi). Transcriptomic profiling of over 21,000 cells revealed that both models recapitulate native keratinocyte subpopulations and differentiation hierarchies. Notably, we identified a signaling mechanism (L1CAM-EZR) involved in melanocyte–keratinocyte communication. Histological and ultrastructural analyses validated tissue architecture and melanin transfer, underscoring the physiological fidelity of the models. This pioneering study provides a high-resolution molecular map of 3D skin equivalents, demonstrating their utility as research platforms for human skin biology, pigmentation, barrier integrity and cosmetic testing. By offering to disentangle cellular complexity, these models represent a significant step toward replacing animal testing with ethical, human-relevant systems.

Zinc Dibutyroyllysinate Promotes Epigenetic Reprogramming and Longevity Pathways via Dual HDAC and Metabolic Modulation, Unlike Rapamycin

Dr. Ratan K Chaudhuri

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Epigenetic regulation underlies all hallmarks of aging and represents a promising therapeutic target. We designed zinc dibutyroyllysinate (ZDL), a compound combining lysine, butyric acid, and Zn^{2+}, to evaluate its effects on cellular longevity compared with rapamycin (RAPA). Using HDAC enzymes, mesenchymal stem cells, primary human fibroblasts, and ex vivo human skin, we assessed HDAC inhibition, mTOR signaling, and extracellular matrix (ECM) regulation. ZDL broadly inhibited classical HDAC isoforms despite lacking a canonical Zn^{2+}-binding motif, while activating mTORC1 signaling and enhancing ECM components. Importantly, ZDL upregulated ALDH1A2, suggesting restoration of endogenous retinoid signaling. Unlike rapamycin (RAPA), which suppresses metabolism and indirectly alters epigenetic marks, ZDL directly modulated chromatin states to promote stemness and counteract senescence. Ex vivo aged skin confirmed rejuvenating effects without dysplasia or hyperproliferation. Thus, ZDL exerts dual HDAC-inhibitory and metabolic actions distinct from RAPA, offering a novel, safe strategy for restoring chromatin plasticity, ECM integrity, and retinoid metabolism in skin rejuvenation.

Breaking the Conventional Code with New Developments in Small RNA-based Actives

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microRNAs epigenetically interfere with protein production by intercepting messenger RNAs (mRNAs) before ribosome interaction. We propose trusting skin cells to efficiently affect repairs by providing instructions in the form of an antagomiR - single-stranded RNA designed to block specific microRNAs. Human microRNA-29a diminishes extracellular matrix (ECM) fibers: collagen, elastin, and fibrillin, earning it the "wrinkle microRNA" moniker. A miR-29a antagomiR was explored to improve skin integrity.

Using an RNA delivery vehicle, antagomiR-29a was tested on fibroblasts. Multiple *in vitro* analyses of treated monolayers demonstrated increased abundance of collagen, elastin, and fibrillin. RHE and skin explants studies similarly showed reduced miR-29a and increased ECM fibers. Lastly, clinical investigations detected improved elasticity, firmness, and thickness with reduced forehead lines.

This novel approach reversed a contributing factor to biological aging: miR-29a expression that diminishes ECM fibers responsible for maintaining resilient skin and countering wrinkle formation, thus supporting an alternative paradigm for active ingredients.

Developing the Future of Safe and Sustainable Black Materials

Scott Fulbright Ph.D. Living Ink

Scott Fulbright Ph.D.

Most black pigments in cosmetics come from carbon black or iron oxides, which raise environmental and safety challenges. Living Ink has launched Algae Black™, a carbon-negative pigment derived from microalgae. This innovation transforms waste biomass into high-performance, renewable colorants that meet beauty industry standards without compromising quality. Algae Black is safe, traceable, and reduces carbon emissions, diverts biomass from landfills and reduces petroleum usage. With growing consumer demand for sustainable and clean ingredients, this breakthrough offers brands an opportunity to replace fossil-based pigments with a safer, climate-friendly alternative—driving innovation and sustainability in the future of cosmetics.