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Speaker Abstracts

Session C: Skin Deep-Chinese Biotechnological Approaches to Skin Care

Expression screening and functional verification of recombinant hirudin from novel chassis cell *Chlamydomonas reinhardtii*

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Hirudin, a potent anticoagulant peptide, plays an irreplaceable role in the treatment of thrombotic disorders. However, the natural sources of hirudin are limited and the extraction cost is high. Although recombinant expression of hirudin has been achieved in prokaryotic systems such as *Escherichia coli*(*E. coli*), the resulting products often exhibit insufficient biological activity. *Chlamydomonas reinhardtii*(C. *reinhardtii*), a photoautotrophic unicellular eukaryotic algae, offers several advantages including ease of genetic manipulation, rapid growth, low cultivation costs, and the ability to perform post-translational modifications, making it a promising chassis for high-yield recombinant hirudin production. In this study, we engineered *C. reinhardtii* strains to express recombinant hirudin via heterologous expression and applied high-density heterotrophic cultivation to obtain lyophilized algal powder. Analysis revealed that the expressed product underwent tyrosine sulfation and exhibited a thrombin-inhibitory activity of up to 20,000 ATU/mg. Oral administration in mice demonstrated significant anticoagulant effects without inducing thrombocytopenia or hemorrhagic side effects. This work aims to overcome the bottlenecks in current production technologies and promote the sustainable, bio-based manufacturing of anticoagulant therapeutics.

Transcending Skin Barriers: Innovative Delivery Strategies for High-Molecular-Weight Recombinant Human Collagen III

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Background: Recombinant collagen is widely used in cosmetics and medical aesthetics, but high-molecular-weight (HMW) collagen suffers from poor skin penetration.

Objective: To enhance the skin delivery of HMW recombinant human collagen III (RHC-III) by developing two innovative technologies: (1) cell-penetrating peptide (CPP)-fused RHC-III and (2) supramolecular hyaluronic acid-based collagen microspheres.

Methods: CPP-fused RHC-III was engineered via genetic modification, while microspheres were prepared by nano-encapsulation. Penetration efficiency was assessed via Franz diffusion cells (24h) and Raman spectroscopy (8h). Ex vivo skin models with immunofluorescence staining were used to evaluate efficacy by measuring skin repair (filaggrin, claudin-1) and anti-aging (collagen I, elastin) markers.

Results: CPP-fused RHC-III exhibited 27.5× higher penetration (Franz diffusion), while microspheres showed 89.51% improvement (Raman spectroscopy). Both technologies showed their significantly more upregulation of key proteins ($P<0.05$) versus native RHC-III.

Conclusion: These advanced skin delivery systems markedly enhance RHC-III penetration and bioactivity, demonstrating strong potential for cosmetic applications.

Oxyresveratrol: A Sensitive Skin-Friendly Depigmenting Agent via Dual Melanin Pathway Inhibition

Jianhua (Josh Zhang

Oxyresveratrol is a promising skin-brightening agent for sensitive skin, combining potent depigmenting efficacy with excellent tolerability. Identified through network pharmacology, it demonstrated superior tyrosinase inhibition and melanin control compared to arbutin and other common actives. Mechanistic studies showed that Oxyresveratrol reduces melanogenesis by downregulating the MC1R/cAMP/MITF pathway and inhibits melanosome transfer. In an 8-week randomized, double-blind clinical trial with 70 Asian women, a 1% Oxyresveratrol formulation significantly improved facial pigmentation, reduced erythema, and enhanced skin comfort. These results highlight Oxyresveratrol as a next-generation brightening ingredient for sensitive skin.

Applications of Terpenoids in Cosmetics and Their Biosynthesis

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Terpenoids, a class of natural products with unique structures, serve as moisturizing ingredients, anti-aging ingredients, fragrance ingredients, and other components in cosmetic raw materials. Traditional plant extraction faces challenges like long growth cycles and geographical limitations. With the rapid development of synthetic biology, an increasing number of terpenoids have achieved large-scale production through biosynthesis. Using synthetic biotechnology to design and construct microbial cell factories for terpenoid production can not only improve production efficiency and reduce production costs but also realize green biomanufacturing, meeting the market's demand for natural, safe, and functionally enhanced cosmetic raw materials. This presentation introduces terpenoids' cosmetic applications, biosynthetic strategies, and research progress on some popular terpenoid raw materials. Empowered by cutting-edge technologies such as artificial intelligence, synthetic biotechnology will surely further promote the innovation process of efficient and green biomanufacturing of cosmetic raw materials.

Mitigating Photoaging via Lapagyl: A Botanical Strategy Targeting Inflammation and Immune Dysregulation

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Photoaging driven by ultraviolet radiation (UVR) accelerates inflammation, immunosuppression, and ECM degradation, manifesting as wrinkles, dryness, and reduced elasticity. While retinoids remain the gold standard, concerns over irritation and instability limit their broader use. This study explores Lapagyl, a sustainably sourced extract from the Lapacho tree, as a natural, well-tolerated alternative. In vivo evaluations demonstrated that Lapagyl significantly improved skin moisture, elasticity, and wrinkle appearance in UVR-damaged skin. Single-cell transcriptomics revealed its unique mechanism: reducing oxidative stress, suppressing CCL8-mediated immune infiltration, and reversing UVR-induced immunosuppression by preventing the expansion of $Foxp3^{+}$ regulatory T cells. These findings highlight Lapagyl's potential as a next-generation botanical ingredient that addresses both the visible and molecular hallmarks of photoaging, offering a compelling balance of efficacy, safety, and sustainability for innovative anti-aging skincare solutions.