SCC 75TH ANNUAL SCIENTIFIC MEETING & SHOWCASE

SESSION A: 75 YEARS OF BEAUTY & BEYOND PREPRINTS

December 13-15, 2021

Sheraton New York Times Square

75 Years of Scientific Innovation and Advancements in Skin Science

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Introduction

There has been tremendous advancement in every area of science since the founding of the SCC 75 years ago. To cover all the advancements in understanding skin and hair and development of new cosmetic products and technology would take many hours. After a brief introduction and discussion of progress in Cosmetic Science Education, this talk will focus on two areas, our greatly improved understanding of the structure of the stratum corneum and advances in skin measurement technology.

Progress in Skin Science

Important work to understand the stratum corneum began with the work Irvin H. Blank on SC water content in the early 1950s.[1-3] Even in the early 1970's there was little understanding of the SC. Standard lipid staining methods did not stain SC lipids (see Loomans and Hannon for an example[4]), there was little work on the structure of keratins and the SC was generally considered to be a dead, semipermeable membrane with no interesting biological activity. However, rapid progress was made in the late 1970's through the early 1990's. The structure of keratin microfibrils was elucidated in large part through the work of Peter Steinert's group [5-7] and the role of transglutaminase[8-10] in forming the resistant SC cell envelope and the structure of that envelope[10-12] was revealed. A SC protein first identified by Dale as Stratum Basic protein[13] was named filaggrin[14] and role of filaggrin in both the SC structure[15-17] and the natural moisturization of SC became clear[18-20].

Great progress has also been made in understanding the SC lipid barrier. Methods for elucidating the structure of the extracellular lipids of the SC barrier were developed[21, 22] revealing their lamellar structure[23]. The bricks and mortar model of the SC barrier was postulated by Elias.[24] In the original model it was postulated that the intercellular lipid of the SC is the "mortar" that holds the corneocyte "bricks" together but in the early 90's the role of SC desmosomes in SC cohesion and desquamation was revealed[25-27]. It also became clear, in large part through the work of the Elias group, that important biological activity does occur in the SC and is required for the conversion of lipids released into the intercellular spaces to competent barrier lipids[28-30].

Major advances in skin measurement technology occurred in the late 1970's and early 1980's. Prior to that time there were few instruments to measure skin properties and they were mostly "home built". The first successful commercial device was the Servo-Med Evaporimeter[31]. Instruments to measure electrical properties of skin, related to water content quickly followed[32, 33]. Now there is a wide range of increasingly sophisticated instruments available to make non-invasive measurement of skin function. To illustrate the growth of instrumentation, the 1989 book *Cutaneous Investigations in Health and Disease*[34] has 16 chapters describing methods to study human skin and the 2006 *Handbook of Noninvasive Methods and the Skin*[35] has116. A recent area of rapid advance is the use of biomarkers obtained from tape strips to evaluate skin health[36-40] and more recently for claim support[41].

The Future

Rapid advances in our understanding of skin structure and function and ability to measure the skin make it difficult to predict the future but at least we can speculate. We can expect our understanding of the SC and of product effects on SC function to continue to evolve. We can also expect that some of the more exotic instrumental methods for skin evaluation such as Optical Coherence Tomography[42] and multiphoton spectroscopy[43] will become more accessible and more widely applied in cosmetic studies. It also seems certain that our knowledge of genomics and proteomics will continue to progress leading to new ways to study, develop and improve cosmetic products.

Conclusion

This very brief review has only "scratched the surface" of the tremendous advances in our understanding of the structure of skin and our ability to evaluate skin that have occurred in the last 75 years. One can only wonder what progress will come about in the next 75 years.

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About the speaker.

Dr. Wickett holds a Ph.D. in Biophysics from Oregon State University. He worked at Procter and Gamble from 1974 to 1985, the SC Johnson Company 1985 to 1991 and the University of Cincinnati from 1991 to Present. He is now Emeritus Professor of Cosmetic Science. He is a SCC Fellow and received the Maison G. de Navarre Medal Award in 1997. He was editor of the Journal of the Society of Cosmetic Chemists from 1991 to 1997, chairman of the International Society for Bioengineering and the Skin from 2000-2005 and is past President of the SCC (2011).

Evolution of the Beauty Industry

Dr Jason Harcup; Unilever R&D FRSC, FRSB

Unilever Global Vice President of Worldwide Skin Care R&D, Global Vice President of Worldwide Prestige Division R&D, Global Vice President of New Business Creation R&D, Head of Beauty and Personal Care R&D in North America

Introduction of research (short paragraph)

Key Technological Milestones in Skin Care: A 75 Year Retrospective

Over the 75 years of operation of the Society for Cosmetic Chemists, the market for everyday Skin Care has grown into a multi hundred billion dollar industry with the best part of half a million products catalogued across a host of worldwide retail channels. In some ways, the industry and consumer landscape that we know so well to be the present day result of this prolific growth in innovation and benefit delivery would probably be unrecognisable to the original founders of the SCC – the advent of commercialisation of omics insights and directed energy methods for intervening in skin condition, for example, being but two significant advances that may well have only been foreseen by very few, if any, back in the earliest days of the SCC. But, that said, it is perhaps true to say that in very many more ways, the early founders of the SCC would probably feel entirely at home with the developments that have taken place in the intervening seventy five years, being as they are based on the underlying physiology which has powered the needs of an organ that, after all, had already evolved to a stable anatomy over millions of years, pre-dating even the foundation of the SCC!

In this retrospective, it seems timely and appropriate to take a pause as we come together as a professional community and reflect over the past 75 years of Skin Care and consider some of the major milestone developments in the fundamental management of the health, wellbeing and normal function of human skin. And perhaps, to take a look to the future, and the next 75 years to come.

Nothing could be more fundamental to skin than water. Indeed, it is not an overstatement to say that water is really at the essential *core* of skin's barrier purpose. Water management is of cardinal importance to the orchestration of the whole epidermal turnover process, and intrinsic to the role of skin, as the 70% water content internal to the body is maintained in place, declining progressively across the waterproof skin barrier to its atmospheric levels of humidity at its surface. Deranged water management can be the consequence of a number of drivers, and moreover, these can often be observed to act in symphony with each other in complex ways. Such drivers include traumatic events, such as wounds, burns and abrasion; genetic variations in how water-proofing is established across as well as within ethnicities; environmental factors such as exposure to ultraviolet radiation or heat; life-stage progression in terms of ageing but also in terms of key endocrine events such as puberty and menopause; psychological factors such as emotional and sub-chronic stress; status of body mass index and vascular integrity; dietary considerations; adherence to good quality sleeping practices; management of the hygiene of skin and of course the general microbial milieu that has been established upon, and within, the outermost layers of the skin. As we will see in our retrospective, when these factors are in play in various ways, the condition of the skin can progress through a number of common phenotypic states, with the process of epidermal regeneration disrupted, leading potentially to skin appearance changes that can be highly undesirable and indeed very

uncomfortable to the sufferer, such as in eczema and dandruff, and even to physical disruption of the skin barrier, with the prospect then beckoning of pathogenic ingress or other disease states in the worst cases. As we will see, it is fair to say that the reinstating, maintaining and enhancing of the basic hydration and moisturisation of skin therefore gatekeeps against a number of highly undesirable phenomena: and indeed, technologies for managing this hydration range from external barrier supplementation through ever more sophisticated manipulation of the lipid bilayer and keratinocyte catabolism, to produce demonstrable clinical value, and underpinning much of the several hundred billion dollar global industry. Lastly, we will also review, on this 75 year retrospective, how a well hydrated canvas is a necessary, and inescapable, pre-requisite for any form of success in introducing to the skin truly efficacious technology capable of mitigating, even reversing, inevitable the effects of time and age.

About the speaker

Dr. Jason Harcup is Global Vice President for Skin Care Research & Development, leading end-to-end R&D delivery from innovation to market in 89 countries, across several billion Euros of turnover. He is also Global Vice President for the billion Euro Prestige Division. He also leads Unilever's North America R&D Campus. He leads several hundred PhDs globally across a dozen worldwide laboratories, delivering more than a billion euros of marketed innovations. He is a Cambridge University Natural Scientist, being elected a Fellow of The Royal Society of Biology in 2016, and a Fellow of the Royal Society of Chemistry in 2015. He more broadly serves the industry as Judge for the RSC Emerging Technologies Initiative, co-convenor of the Asian Dermatological Forum, having grown and headed up a $60m R&D facility in Shanghai, as Faculty for Health and Beauty America, Beauty Disruptor with the CEW network, and frequently contributes presentations and articles.

75 Colorful Years

Presenter Name; Jane Hollenberg/JCH Consulting

Preprint:

The SCC's first Annual Meeting was 75 years ago, (1946), just after the end of World War II. As the chemical industry changed focus from war to peace, novel raw materials and technologies became available for consumer products, leading to the sometimes-overwhelming choices available to cosmetic formulators in 2021. To compress all the innovations into highlights in color cosmetics is a daunting task.

The **regulatory issues**, now almost forgotten, that dominated a portion of the 75 years in color cosmetics, were the time consuming, expensive efforts to secure FDA approval of all color additives under the Color Additive Amendments of 1960. The extensive testing program involved, lasting over thirty years, was funded by industry and coordinated by CTFA (now PCPC).

Mild surfactants were developed. capable of forming stable emulsions that delivered color in an easily spreadable and blendable form. Liquid foundation (early 1950's), were pigmented Triethanolamine-Stearate oil in water emulsions stabilized with water dispersible suspending agents, and newly available ethoxylated nonionic emulsifiers that introduced easily applied, easily blended, natural looking face color. These "liquid makeups" soon took over the foundation market. Silicone/glycol emulsifiers, introduced in the early 1980's, formed cosmetically elegant water in silicone emulsions that became the vehicle of choice for emulsion foundation. More recently, o/w and w/o emulsifiers having more naturally derived hydrophilic groups have been developed to respond to consumer demand for more "natural" ingredients.

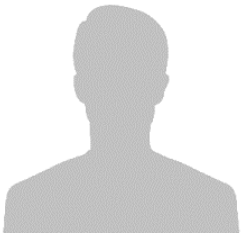
Emollient oils, particularly synthetic and naturally derived esters, were developed with a variety of alkyl chain lengths and structures to give the formulator a range of textures and finishes to use in foundation, lip color, and eye products to satisfy the needs of all skin types. In the 1970's, volatile oils began to be used as partial replacements for conventional emollients in "automatic" vial packaged eyeshadow and mascara, then in emulsion foundation. Volatile silicones and hydrocarbons provided slip and playtime during application, then evaporated leaving behind non-greasy, longer wearing color. Although now out of favor with some consumers for a partly petroleum origin, silicone chemistry provided light, non-occlusive, non-greasy emollients with exceptional slip.

Synthetic pearlescent pigments deriving their effect from light interference created by a thin film of titanium dioxide deposited on mica, were the most dramatic addition to the effects possible with color cosmetics. From a simple beginning with synthetic white pearl flakes in the 1960's, the technology of metal oxide coatings on transparent flaky substrates evolved to give us a dazzling array of light reflection and colors.

Film formers were introduced into color cosmetic to lengthen the wear of formulations for lips, eyes, face, and nails. Polyacrylates, polyvinylpyrrolidone copolymers, and polyvinyl acetates, natural resins, polyamides, silicone resins, and, more recently, complex curable polyacrylates to form gel nails have made possible claims such as "transfer resistant", "waterproof", "wear proof", "resists oil breakthrough", and "kiss proof".

Surface treated pigments (ca 1980) were another totally new development for color cosmetics that greatly improved application, performance, and processing characteristics. Pigment and filler surfaces could be modified to become hydrophobic, hydrophilic, lipophobic, or lipophilic to affect

tactile feel, dispersibility, and wear. "Soft touch" pressed powders, hot poured "powder creams", water in silicone emulsion foundations, and nail lacquers having reduced settling were product forms made possible by surface modified pigments.



INCI Nomenclature: A Historical Perspective

Joanne Nikitakis

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Have you ever wondered what is meant by the names: Amidino Beta-Alanine and Amidinocysteine; or s-Solitary Bee Oligopeptide-1 and s-Spider Polypeptide-6? These two groups of names are similar because they follow the same naming style. This style is officially called INCI which stands for **I**nternational **N**omenclature **C**osmetic **I**ngredient and is a system of standardized names for cosmetic raw materials.

The INCI concept dates back to the beginning of the consumer movement when products were not ingredient labeled. At the time, cosmetic chemists referred to raw materials by colloquial terms and trade names, such as IPM, Lantrol, or Spans and Tweens. But these names could only be identified by those working around the bench and did not have meaning to the lay person. With the enactment of the Fair Packaging and Labeling Act in 1967, the FDA was authorized to publish regulations requiring the declaration of ingredients for cosmetics. In order to help consumers make fair value comparisons between products (which was the original intent of the law), standardized names were needed, and this set the stage for the creation of INCI nomenclature.

To accomplish the monumental task of creating a nomenclature system, the industry trade association (CTFA, now called PCPC) established a Nomenclature Committee with representation by chemists from industry, academia, the FDA, USAN and FCC. The collection of names that transpired, along with related technical and regulatory information, was compiled and published in "The Dictionary" which has now passed its 16th edition and contains over 27,000 ingredient monographs.

The Dictionary, formally called *The International Cosmetic Ingredient Dictionary and Handbook*, is an essential reference for cosmetic ingredient information, and the primary source for INCI names. INCI names are recognized by many international regulatory bodies and have become the de facto standard for cosmetic ingredient labeling. The purpose and importance of a uniform global nomenclature system cannot be overestimated. Businesses gain efficiency when labeling with standardized terms; consumers are provided with transparency regardless of the origin of the product; and most importantly, consistent communication of ingredient information is facilitated which is crucial for identifying materials associated with adverse reactions and tracking the safety and regulatory status of ingredients on a global basis.

There is a formal process associated with coining a new INCI name which is initiated by request (usually from ingredient suppliers) through an online application. The names are designated by the International Nomenclature Committee (INC) through consensus at face-to-face meetings, and the creation of the names is guided by conventions and principles that have evolved over decades. The conventions are dynamic and continually updated as new ingredient technologies emerge. The INCI Conventions are published in the Dictionary and accessible online through www.personalcarecouncil.org.

This presentation on INCI will provide historical insight on the development of the INCI nomenclature system and highlight the changes that have evolved in ingredient technologies and corresponding naming approaches in recent years.

About the speaker

Joanne Nikitakis is a member of the science team at the Personal Care Products Council as the Sr. Director of Cosmetic Chemistry. In her role, she serves as the staff liaison for PCPC's Quality Assurance Committee and the International Cosmetic Ingredient Nomenclature Committee and provides technical support for the various activities associated with these Committees. For more than 25 years, Joanne has been involved with the development of the INCI nomenclature program and publication of the International Cosmetic Ingredient Dictionary and Handbook in which she serves as principal editor. Joanne has also served as editor of the Council's Quality Assurance Guidelines, and the Compendium of Cosmetic Ingredient Composition.

Ms. Nikitakis received her B.S. degree in Chemistry from the University of Mary Washington in Fredericksburg, Virginia, and M.S. in Pharmaceutical Sciences from the University of Cincinnati, College of Pharmacy in Cincinnati, Ohio.

Innovation Driving the Future of the Beauty Industry, Serving an Inclusive Consumer, and Attracting Diverse Talent

Lisa Napolione; The Estée Lauder Companies

Introduction

When envisioning the future of beauty, there are many essential questions to ask: what innovations will be driving the industry? Who will be leading the development of these technologies? Which consumers will engage with products? Although the future of the cosmetics industry is unknown, a variety of modern factors hint at potential outcomes.

Innovations of the Future

The cosmetics industry is a hotbed for innovation, and certain trends in this space will only become more important in the decades to come. As researchers gain a stronger sense of genetics, epigenetics, and their role in human skin, the depth to which skincare can be personalized to address hyper-specific consumer needs will only increase. At the same time, cutting-edge discoveries in microbiomes, materials science, and systems biology will drive product development and new benefit spaces. Understanding the skin under a plethora of lenses, such as viewing the skin as a system of highly interactive cells and signals, or viewing it as a polymer composite material, will open our eyes to new perspectives and areas for advancement in the cosmetic space.

Personalization and other areas of innovation will be driven by technology that enables engagement and enjoyment. Cosmetic devices, which have already entered the routines of many consumers, will address more skin and hair concerns than ever before, in ways that maximize ease and safety of use for all. At the same time, the push for sustainable beauty, whether in packaging, formulation, or manufacturing is only going to strengthen as consumer concerns for the environment heighten.

Diversity, Inclusion, and Equity in Our Future

The surge of inclusion in the beauty industry will also develop and broaden. Consumer desire for diverse and inclusive beauty evolves every day, encompassing not only racial and ethnic identities, but also identities across the spectra of gender, age, physical ability, socioeconomic status, and more. The key to success in the future of beauty will be to create space for all potential consumers, and this process doesn't end at diversity and inclusion in the consumers reached.

Equity, the final piece of the puzzle, is necessary for our industry to navigate the future successfully. Beyond meeting the product desires of consumers from all walks of life, the beauty industry must expand who has agency and power in its research and product development process. Attracting a diverse pool of talent is key and this process begins in schools, where people first begin to imagine futures for themselves, and is fueled by mentorship, networking, and applied professional opportunities such

as internships. To enable the beauty industry's innovative future, there must be a drive for more equity in STEM education and professional development opportunities, which we as a community can support.

Conclusion

As the global leader in prestige beauty, on what is also our 75th anniversary, The Estée Lauder Companies must continue to register where this industry is, and where it is going. Innovative technologies will drive new products in the coming years, but these innovations must be suited for inclusive consumers and developed by diverse talent. Together, as a community, members of the Society of Cosmetic Chemists must strive for a future in beauty that addresses these areas. Such a future will not only drive success in market, but also create a better world of beauty.

About the speaker

Lisa Napolione is Senior Vice President of Global Research & Development, Estée Lauder Companies, with responsibilities for applied research, advanced technologies, and product design for all brands and laboratories. Previously, she held roles as Global Head of R&D for Novartis Consumer Health and R&D VP at Procter & Gamble. Her technical career has spanned pharma drug delivery, skin and beauty science. She graduated from Clarkson University in chemical engineering and biology, and she currently leads their Faculty Research Sub-Committee. She is an active mentor to students in STEM, is a Women in Technology sponsor and is a YMCA Rising Star. She also developed the Nature Research Awards for Inspiring Women in Science in partnership with Nature Research.