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Consumers want value-added cosmetics that offer the scientific advantages of the prestige brands, but cost less and are available in convenient mass market outlets. They crave quality-of-life enhancing products. Young women are looking for trendy, portable products to suit their hectic lifestyles. The current trend in cosmetic R&D, therefore, is to develop products that communicate science to the consumers and are also cross-functional. Convenience and simplicity are taking precedence over elaborate regimens. Product performance has become a complex issue, as consumers are more aware of cosmetic ingredients and their functions. Yet, these same consumers often fail to recognize the benefits of these ingredients, either due to low use levels or the mediocre in-house base utilized in compounding. The aging U.S. population has increased the need for technologies and products such as anti-wrinkle products, hair regrowth, cosmeceuticals with vitamins, nutritionals, sunscreens, herbs and various anti-aging ingredients. More suppliers of personal care raw materials now have a product line which has cross-functional/cross-category applications; e.g., the same raw material is used in cosmetics, skin care, toothpastes, hair care and AP/Deos. Also, there is increasing popularity of multi-purpose products designed for use on a combination of face, eyes or lips.

In Asia, the skin lightening/whitening category is expanding and is the current driver for new technologies which provide skin lightening with multifunctional advantages, such as UV protection and anti-aging. During the past couple of years, the herbal wave has been sweeping the skin care segment and is perceived to be the hottest and the fastest growing. A slew of companies launched herbal skin care products. In India, players such as Shehnaz Hussain's franchises of Ayurvedic herbal skin and hair care salons have been in this segment for quite some time with more than 350 skin, hair and body care products. With the huge potential of this segment, existing players too have

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expanded their product ranges to include herbal variants. For instance, Hindustan Lever (a division of Unilever) recently introduced an herbal version of its popular Fair & Lovely brand.

Growth in ethnic hair and skin care technologies is due to the fact that 35% of the U.S. population is non-Caucasian and 80% of the population outside the U.S. is non-Caucasian. Delivery systems that now play a dominant role in cosmetics and personal care products are micro and nano particles (core shell and matrix systems), porous micoparticles, liposomes and cyclodextrins. Nanotechnology is extremely important to future innovations in active ingredients used in innovative products.1 Nanoparticles, microcapsules and nanoemulsion technologies are the desired delivery systems for cosmeceuticals, color cosmetics and personal care products.

Supplier Moves

To keep ahead of the innovation curve, suppliers are using a number of strategies. The following are just a few examples. Akzo Nobel and BASF formed a 50-50 equity joint venture to produce chelates in North America. BASF has launched Luviset Clear, which is billed as an innovative styling polymer for clear hair gels that offers unrivaled properties such as very strong hold, even in humid environments.

Symrise was established in 2003 with the merger of Haarmann & Reimer and Dragoco. The company is a global producer of flavors, fragrances, aroma chemicals and cosmetic ingredients.

Uniqema has developed an R&D-based formulating tool called SenSelect that combines consumer research, formulating expertise and software algorithms to deliver very specific sensory experiences into formulations. This will help formulators take much of the guesswork out of building the foundations, helping them rapidly create the sensory experience they want in their products.

Chemidex Cybrary is the chemical industry's largest technical data sheet repository, providing continuously updated raw material data sheets, starting point formulations and product bulletins from the leading chemical companies. It accelerates the exchange of technical information between chemical suppliers and finished product manufacturers.

About the Author

Vispi Kanga was a principal global technology manager at Unilever and has more than 25 years of experience in product development in skin care formulation, project planning, supplier networking and development of skin care products from concept to commercial production. His expertise in generating new technical knowledge, creating learning materials and dealing with multi-disciplinary groups has resulted in the development of new and innovative products. Mr. Kanga's work has resulted in several patents related to skin care formulations. He received his MS in pharmaceutics and cosmetic systems from Arnold & Marie Schwartz College of Pharmacy & Health Sciences, Long Island University, New York and his BS in Pharmacy from the University of Gujarat, India.

Most recently, he formed Cosmet-Pharm Consultants LLC. The Cresskill, NJ-based firm is dedicated to the needs of the cosmetic, personal care and OTC topical drug products industry both domestically and globally. It has expertise in providing and communicating technical knowledge, customized training and knowledge management through on-site training seminars, presentations and product related short courses. It also provides services in product development, technology assessment, cost

savings and supply chain issues. E-mail: vkanga@optonline.net or Tel: (201) 227-1890.

Anti-Aging Will Dominate

Anti-aging treatments account for the lion's share of growth in the skin care market. Consumers expect fast, visible results. To deliver these results there is a growing trend by companies to rely on the use of advanced technologies. Delivery systems play an increasingly important role in the development of effective skin care products. Nanoparticles can be subdivided on the basis of the encapsulating membrane structure into liposomes and nanoemulsions/ nanosomes/nanotopes.

Unilever expanded its presence in the anti-aging segment in a big way with the recent launch of Dove Essential Nutrients. The nine-item line of cleansers, moisturizers and toner includes day lotion and day cream that boast SPF 15 protection. But all the products contain a proprietary complex of lipids, amino acids, minerals and vitamins A, E and B5.

P&G introduced Olay Regenerist with Olay-exclusive amino-peptide complex to help regenerate the skin's appearance without irritation by renewing the skin's outer layer one cell at a time. The amino-peptide complex is a combination of vitamin B3, allantoin, pro-vitamin B5, vitamin E and green tea extract. The three-item line also includes a lotion that provides UV protection.

Klein-Becker's anti-wrinkle cream StriVectin-SD is gaining popularity as a Botox alternative. Though it has not been shown to eliminate the deep furrows targeted by Botox injections, the product, backed by clinical trials, has been shown to significantly reduce fine lines and wrinkles faster than retinol, is far superior to vitamin C and without irritation, painful injections or surgery. The active ingredient of Striadil complex is a patented palmitoyl oligo-peptide (Pal-KTTKS) and numerous botanical extracts.2

Lancôme's Résolution Eye D-Contraxol Intensive Anti-Wrinkle eye treatment contains a breakthrough treatment designed to target the eye contour area. The product includes D-Contraxol, an exclusive dermo-smoothing complex containing anti-elastase agents and nanocapsules of vitamin A and matrixine, a skin strengthening ingredient.

NuSkin's Tru Face Revealing gel contains lactobionic and gluconolactone acids that enable even irritated and sensitive skin to benefit from the cell renewal properties of hydroxy acids without the stinging or burning associated with these ingredients. According to the company, lactobionic acid acts as a powerful antioxidant and chelates excess iron in the skin, thereby reducing potential oxidative damage.

Lipotec has a new anti-wrinkle peptide, Argireline (acetyl hexapeptide-3). According to Centerchem, which distributes Argireline, the material "works through a unique mechanism which relaxes facial tension leading to a reduction in superficial facial lines and wrinkles with regular use. Argireline has been shown to moderate excessive catecholamines release." It is claimed to measurably plump surface lines to help smooth away visible signs of aging and reduce the depths the wrinkles in the face caused by the contraction of facial muscles, especially in the forehead and around the eyes.

O/W microemulsions are prepared as transparent vehicles for water-soluble sunscreens, rather than diluted milks or transparent dispersions that are quite frequently washed away from the skin. They are waterproof, non-sticky and spread easily. The microemulsions are prepared by using pseudoternary diagrams, by combining lipids with surfactant blends and a polar phase. Soya lecithin and decylpolyglucose produce transparent systems with the lowest percentage of surfactants. These microemulsions contain 4-methylbenzilidene camphor or octylmethoxycinnamate as sunscreen agents. Cyclomethicone, menthol and allantoin

give products a good skin feel, and stearyl methicone provides a waterproof effect. These systems show a Newtonian flux. Little permeation of the sunscreens' lipophilic and hydrophilic membrane is evidenced.3

A Natural Anti-Inflammatory Agent

Boswella is an Ayurvedic herb that has been used in contemporary medicine as an anti-arthritic and anti-inflammatory pharmacological agent. Boswellic acids were found to inhibit two pro-inflammatory enzymes, 5-lipoxygenase (which generates inflammatory leukotrienes) and human leukocyte elastase (HLE). HLE is a serine protease which initiates injury to the tissues, which in turn triggers the inflammatory process.4 This dual inhibitory action on the inflammatory process is unique to boswellic acids. In 1991, Sabinsa Corporation pioneered Boswellin, a standardized extract containing boswellic acids, for the U.S. market. L'Oréal is targeting women unwilling to try Botox with its Wrinkle De-Crease with Boswelox that claims to counteract skin micro-contractions and visibly correct wrinkles. Boswelox is a phyto-complex combining boswellic acid and manganese and is said to reduce the appearance of expression lines and wrinkles within three weeks of use.

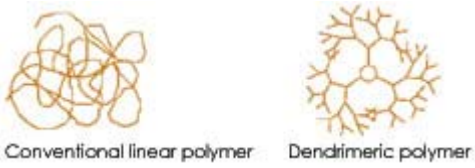
Unilever expanded its presence in the anti-aging segment with the recent introduction of Dove Essential Nutrients.

Treatment for wrinkle reduction by ICN Pharmaceuticals' NLite "Laser Collagen Replenishment" is the first selective class IV medical non-ablative laser system cleared by the FDA. This treatment for wrinkle reduction is non-invasive and does not wound the surface of the skin, eliminating the need for post-treatment care. The light from the laser targets the tissue under the skin surface, stimulating new collagen growth. The new collagen growth fills in the depression under the wrinkle, reducing the crease in the wrinkle surface.

Reconstructed skin, developed in 1979 for grafting severe burns, now forms a valuable model for testing new cosmetics. Skin is made up of several layers with different mechanical, elastic and optical properties, giving it a multitude of aspects and behavior patterns that vary according to age, sex and ethnic origin. Many physicists, biologists and chemists have analyzed the skin's properties. Polymers have been found to make an excellent scaffold for growing cells. Today, more than 25 different cell types of both human and animal origin can be grown on polymer scaffolds. In the recent past, research focused on the novel properties of a polymer membrane with an adjustable pore size. The synthetic biodegradable matrix, called Polyactive, which is an elastomeric poly (ether)/poly (ester) block copolymer, has been found to be quite useful in dermal regeneration.5 This matrix is available as a porous substrate, with gradually changing pore size (Biskin-M), or as a bilayer made of a porous underlayer with a fully dense surface layer (Biskin). Van Dorp et al at the department of biomaterial research, Leiden University Medical Centre, have studied the efficacy of this novel block copolymer in promoting dermal regeneration. Another artificial skin tissue that is gaining in popularity is known as Integra artificial skin.6 The tissue is essentially a dermal template made of bovine collagen, chondroitin-6-sulphate and a silastic membrane. It has been found to be effective in the clinical treatment of third degree burn wounds.

The Center for Biotechnical Development and Research, Taipei Medical College, has examined the role of the sacchachitin membrane prepared from Ganoderma tsugae for its effects on wound healing and the proliferation and migration of fibroblast cells. Results indicated that both 0.01% w/v of sacchachitin, a membrane derived from the fruiting body of a fungus called Ganoderma tsugae and chitin, significantly enhanced

the proliferation and migration of fibroblast cells.7



Fractal Polymers

Fractal polymers or dendrimers form a new class of macromolecules or polymers (large molecules) which have a regular branching structure. Conventional polymers, for example, polystyrene, polyethyleneterephthalate (PET), and polyvinylchloride (PVC) are basically long chains; i.e., linear polymers. Dendrimers, when produced by stepwise synthesis (linking branches in stages, from the edge, or leaves down to the core, or root) are monodisperse. This means that these polymers have a precise molecular weight and size. Normal polymer synthesis results in a mixture in which chains are of differing lengths, and so there is a distribution of molecular weights and sizes.8 Here's a schematic illustration:

When these polymers are large, they tend to form nice spherical shapes with a well-defined interior and exterior. This results in some of their peculiar properties, in particular, low specific viscosities. They also act as molecular micelles, in which they become special containers for other molecules. The surface activity of dendrimer branches arises from the hydrophobic edge and the hydrophilic core, so that these branches tend to stand up on a water surface like a nano-forest, with the cores (roots) going into the water, and the branches going up into the air. If a small amount of these dendrimers is spread, they will form an extremely thin molecular film, only one molecule thick (a monolayer).

If the water surface area is reduced, the molecules will be clumped together, and the monolayer gets squeezed. This causes mechanical resistance, which is registered as a change in surface tension. If the monolayer is compressed enough, then it must relieve the stress by moving from two dimensions to three. This means that the molecules either go into the water, or go up into the air making thicker films (multilayers). A polymer having a fractal configuration has superior properties as an interstitial material for the adsorption of substances, and as a vehicle providing a new surface delivery system for chemicals, therapeutic drugs and the like. They can support or encapsulate active components of various sizes, are self-filtering, compressible, can be made biodegradable and are non-toxic. Their unusually large specific area is the basis for their possible application as catalytic support and more generally as a support for molecular layers of active components for the pharmaceutical, cosmetic and chemical industries. Particularly, a small addition of fractal polymer FPEC (fractal poly-epsilon caprolactam) increases the efficiency of cleaning agents. The addition of fractal polymer to skin care products changes the geometry of the interface with the skin, each molecule acting like a microscopic broom. When added to soaps they considerably improve the cleansing properties, permitting a complete removal of impurities even when gentle, natural cleansing agents are used. These deep cleaning soaps are designed to gently buff away dead cells with local delivery of moisturizing agents through fractal polypeptides, leaving the skin silky soft. When fractal polymers are added, even in small quantities, to shampoo formulas, the cleaning efficiency is increased considerably. Published university studies into the efficacy of fractal polymers as an additive to cleaning agents show that cleaning time is reduced by half, with less residue, when 0.25% FPEC is added. This permits the use of more gentle cleaning agents in the shampoo formula, leading to less hair and follicle damage. Fractal Interface Inc., Manchester, MA, has created a mint body soap containing 0.45% FPEC and 0.4% glycolic acid. Another product, lavender beauty soap, contains 1.3% FPEC and 1% lavender oil.9

Color cosmetics dominate the performance driven, consumer-oriented ethnic market. Sueños Unlimited launched Sueños color-safe hair care products for the Latina consumer. The line includes Ultra Smoothing shampoo and conditioner, Smooth and Control lotion, Deep Smoothing treatment and Anti-Humidity Control spray.

Breeze Products, FL, has five new lotions: Diamond Elite bronzer; Diamond Elite Fire; Diamond Elite Ice; Diamond Elite moisturizer and Diamond Elite intensifier. They offer unique ingredients to help produce, maintain or revitalize a glowing tan.

Cover Girl Fantastic Lash mascara is a breakthrough in volume-building mascaras, according to company executives. It thickens lashes from root to tip as it separates them, creating full, thick lashes without clumps. Fantastic Lash mascara comes in Very Black, Black and Brown. L'Oréal introduced the Glam Shine Lip Color collection, featuring a micro-crystal technology that amplifies light reflection, plumps lips and creates dimension and volume.

Men Are Not Ignored

Men's facial moisturizers captured 26% of the men's skin care market in the anti-aging segment in the first half of 2003. The men's skin care category increased 18% during the five years between 1998 and 2002. In the first half of 2003, men's skin care sales rose 4% to $22.7 million.10 Product sales in the once-niche category exceed $3.5 billion.11 In line with this growth, raw material suppliers such as ISP and Croda are marketing ingredients targeted to rejuvenating men's skin. The biology of men's skin, especially facial skin due to shaving, is quite different from that of women. Niche-market products for men are poised for future growth.

New Ideas in Packaging

Packaging design and innovative dispensing technology makes the difference at point of sale and increases the average selling price per transaction. Chicago Paper Tube & Can Co. was named a finalist for the HBA International Package Design Award for its 100% paperboard tubes in round, oval and custom shapes, suited for cosmetic, fragrance and gift-set packaging. The winners in the mass and limited skin care were: Biospecific product line from Yves Rocher and Stallex skin care collection, respectively.

Revlon's new Moisturous lipstick has a custom case designed by Watertown, CT-based Risdon-AMS. The package features a see-through plastic "button" in the base containing a plastic insert that is custom-colored to match or simulate the true color of the lipstick product. The color insert is PETG overmolded with a PETG clear resin. The metal cover and base are anodized in a bright, gunmetal color.

Rembrandt NightTime Whitening gel has a sponge stylus applicator that turns with a click to dispense the correct amount of gel. It forms a paste-like mask on the teeth.

3C Inc. has a Mini Airless container (4-10ml) for sample packaging. The container, which is a standard top-fill design, features a snap-on collar and a lotion actuator for easy assembly. A Dual-Chambered clear dispenser from Roberts Cosmetic Containers features two compartments that are designed to keep two parts of a product separate until they are dispensed.

Unicap Packaging offers to the industry a Twist-Tip single-use vial standing upright in a clear polypropylene resin version that provides good barrier features for increased product protection and extended product shelf life. Unilever Cosmetics International has low profile pumps on the soft-touch, extruded blow-molded bottles for Calvin Klein's Sheer Obsession Foaming bath and shower mist.

Rexam Dispensing Systems also helped develop the line's neck finish. Victoria Secret's Rapture Golden Pearl shower cream has a five-layer laminate tube with a full-panel holographic rainbow hot stamp foil developed by CCL Packaging.

IMX Cosmetics has launched a first-of-its-kind custom cosmetics line that allows customers to mix their own personalized recipes for lip gloss and nail polish and retrieve them at in-store computer kiosks called Mixing Stations, using their MX (Mix) Stick, a Texas Instruments low frequency (134.2 kHz) Radio frequency identification

(RFID) technology-based clear keyfob or transponder that attaches to the customer's key chain. Customers choose colors from an on-screen color palette, and add an assortment of finishes, glitters, flavors and fragrances. Once a customer makes her selections, color cartridges and pumps are set in motion as the product is mixed and dispensed automatically and in full view at the Mixing Station. After the personalized gloss or polish is bottled and purchased, the unique recipe is saved for the customer to retrieve quickly and easily at any mixing station, either at the same store or at another IMX Cosmetics location, using her RFID MX Stick. Next time the customer comes in, she can wave the wand near a reader built into the kiosk, see what lip gloss she mixed up previously, make a new concoction and add it to her recipe list.

RFID is now attracting tremendous attention as manufacturers and retailers alike require improved visibility and tracking throughout the supply chain. By January 2005, Wal-Mart will require 100 key suppliers to work with the retailer using RFID to track pallets of goods through its supply chain.

U.S. demand for cosmetics and personal care products will rise to more than $34 billion by 2007. Aging consumers crave quality-of-life enhancing products , creating increased demand for anti-aging products, especially formulas that rejuvenate men's skin.

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