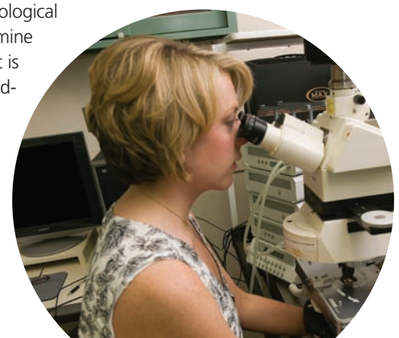
IN THE SPOTLIGHT

Procter & Gamble is one of the ten most innovative companies in the world, says *BusinessWeek* magazine. The April 24, 2006, article cites one of the key reasons for that accolade is P&G's strategy of "Connect and Develop," which matches innovative thinking from the best minds outside the company with technical expertise from scientists inside the company.

P&G Beauty has embraced this concept, notably with its 2003 launch of Olay® Regenerist. This product grew out of a partnership with Sederma, a company that had researched and subsequently manufactured the key peptides involved in wound healing, a technology that Regenerist was able to reapply to reduce the appearance of wrinkles.

Similarly, scientists at P&G Beauty approached skin-imaging expert Astron Clinica to help find better ways of measuring the biological variables that determine skin tone. The result is the SIAscope, a hand-held imaging instrument based on technology that was first used for noninvasive skin cancer detection. This tool was the first to show simultaneously the levels of melanin, collagen, and hemoglobin in the skin—the three key molecules responsible for overall skin tone. P&G Beauty continues to use the instrument in their testing programs and in the development of hyperpigmentation treatments.



"By developing mutually beneficial relationships with innovative researchers from industry, medicine and science, we can leverage our core competencies with external knowledge and innovation capabilities to create greater opportunities for new and existing P&G Beauty brands," said Dr. Shekhar Mitra, Vice President, Global Personal Beauty Care Research & Development, P&G.

FAST FORWARD

Although people from many cultures have used natural extracts as traditional remedies for thousands of years, the products themselves are often surrounded by mystery and folklore. Science knows little about the active ingredients contained in many natural products. Furthermore, the extracts can vary in potency from place to place and year to year, presenting a significant barrier to their use by the modern cosmetics industry. Recently, P&G Beauty scientists began a widespread search for natural bioactive compounds using new, high-throughput analytical methods. The multinational team has succeeded in identifying and authenticating the chemical make-up of many plant extracts. With this knowledge, scientists can test the effects of standardized doses on skin and hair. The result will be new products that contain natural bioactive extracts with real and measurable benefits.

DID YOU KNOW?

Since 1974, P&G Beauty has conducted 108 anti-dandruff clinical trials that have included more than 42,000 patients around the globe. The technology developed through these clinical trials has made P&G's anti-dandruff shampoo the most widely used in the world.

P&G BEAUTY SCIENCE

P&G Beauty Science has more than 1,800 scientists and technical employees working at eleven global technical centers with an unparalleled commitment to technology development. Company scientific efforts have resulted in over 3,500 active beauty care patents. This allows P&G to develop products uniquely suited for different types of hair and skin, and tailored to different cultures and climates. P&G scientists are constantly seeking new ways of turning inspiration into innovation.

P&G Beauty sells more than 130 different brands that touch and improve lives daily in over 180 countries worldwide. P&G Beauty had more than $21 billion in global sales in fiscal year 2005/06, making it one of the world's largest beauty companies. The leading global beauty company at mass, P&G Beauty brands include: Pantene®, Head & Shoulders®, Olay®, Max Factor®, CoverGirl®, Gillette® Complete Skincare™ for Men, Always®, Joy®, Hugo Boss®, Wella®, Herbal Essences®, Clairol Nice 'n Easy® and SK-II®. Please visit **www.pg.com** for the latest news and in-depth information about P&G Beauty and its brands.

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P&G beauty

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BREAKTHROUGHS: SCIENCE NEWS FROM P&G BEAUTY

SCIENTISTS MIMIC KEY MOLECULE ON HAIR SURFACE TO REPAIR COLOR DAMAGE

Any woman who has permanently colored her hair can tell you that the coloring process changes the way her hair feels and behaves. It often feels rougher and drier and over time loses color and shine to become dull in appearance. However, scientists were at a loss to explain all the changes found in color-treated hair. When examining color-treated hair using microscopy, the traditional way of evaluating hair damage, scientists often found the color-treated hair fiber looked normal. Yet the sensory properties of the hair were clearly different. This required scientists to look beyond the visual changes in hair to the physiochemical changes resulting from hair coloring.

What's Inside

- Computer technology aids researchers in virtually exploring eyelash beauty
- Skin mimic tool allows testing of new ingredients on a non-living model
- Mask improves skin hydration, texture, and pigmentation evenness

COLOR STRIPS F-LAYER

Since the beginning of the last century, it has been known that the outside surface of a healthy hair cuticle is covered by a thin, protective, hydrophobic (water repellant) layer the thickness of only a single molecule. However, it wasn't until the 1980s that this layer was identified as 18-methyleicosanoic acid (18-MEA), which is covalently bound to the surface of the cuticle. Hair researchers have named this the F-layer. This permanently attached fatty acid layer makes the hair hydrophobic and contributes to hair's natural smooth and lubricious feel.

When hair is treated with a traditional permanent oxidative hair colorant, one unintended side effect of the coloring process is that the F-layer is stripped away from the cuticle surface. The permanent removal of the F-layer significantly changes the physiochemical nature of the hair surface. The most noticeable change is a shift in the hydrophobic nature of the hair, in fact completely reversing this property, leaving the hair hydrophilic in nature. The illustration shows the impact of changing the hydrophobicity of the hair with water easily beading up on hair that has an intact F-layer, while a water droplet absorbs quickly into hair that has been color treated and has lost its natural hydrophobic layer. Another important change is to increase the hair's friction potential by removing its natural lubricant. The result is hair that feels drier and rougher and is more susceptible to frictional damage.

The image on the left shows water easily beading up on hair that has an intact F-layer, while on the right a water droplet absorbs quickly into color-treated hair that has lost its natural hydrophobic layer.

NEW FORMULAS AND INGREDIENTS DEVELOPED

P&G Beauty scientists have used this knowledge to direct the development of new conditioner formulas and ingredients. One specific new development is the use of cationic surfactants such as BAPDMA (behenyl amidopropyl dimethylamine glutamate). This molecule has a positively charged end group that helps it bond to the stripped cuticle surface. It has a long alkyl tail to mimic the lost fatty acid (18-MEA) of the F-layer. The result is restoration of the hydrophobic properties of hair and a smoother, more lubricious feel. In addition, an unexpected bonus of restoring the hair's own water repellency was the reduction in hair color fading due to color being leached away by water during shampooing and bathing.

(continued on page 2)

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"The good news is that by understanding the biology and physiochemical properties of hair and by careful choice of ingredients, researchers can reverse the well-known issues associated with color-related hair damage from a regular rinse off conditioner," said Frauke Neuser, PhD, P&G Beauty Senior Scientist.

Work is now underway to apply this knowledge to the fundamental chemistry taking place during the coloring process that causes the F-layer to be removed. This information may also be used in the future to develop hair coloring products that actually preserve the F-layer and the hair's own natural look and feel after coloring.

Frauke Neuser, Ph.D, is a P&G Beauty Senior Scientist. "We've developed treatments that can return important protectant properties to color treated hair to help restore its original health and brilliance."

VIRTUAL REALITY EYELASHES GIVE MASCARA A MAKEOVER

For almost 100 years, women have been using mascara to dress the windows to their souls. From cake mascara that was wetted with a stiff brush, to the first twisted wire brushes, to the latest molded bristle breakthrough, mascara has come a long way from the early days of coal dust in petroleum jelly. Now, a century later and with new resources in their scientific make-up bag, P&G Beauty scientists are using 3-D computer modeling of consumers' lashes to explore lash beauty virtually, before the applicators and mascara are designed.

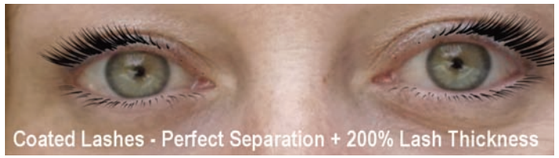
Using the same technology seen in dazzling animated films, the engineers and scientists first mimic consumers' real eyelashes and then simulate how those lashes can be made more beautiful. "For the first time we can actually explore both the true limits of current products and the unrealized potential of products that are in development, or yet to be invented," explains P&G Beauty Senior Engineer Peter Wyatt.

The process starts by digitally removing the eyelashes from photographs of consumers. The actual lashes are then replaced in the computer model with "digital lashes"—3-D representations of the eyelashes that can be styled in any way. These digital lashes are tuned first to look exactly like the consumers' real lashes. From this baseline, the technicians can adjust properties like lash thickness, lash lift, and lash separation to achieve a variety of looks. These looks are then screened with the same consumers to determine if they like the new look more than their typical mascara look. In this way, P&G Beauty can develop new mascara products that achieve the desired lash looks—even the next frontier of looks not yet attainable with today's products.

And this is just the beginning—P&G Beauty scientists are now simulating how the applicator interacts with the eyelashes to build ideal lash looks. Although a consumer version of this virtual lash system is probably several years away from the make-up counter, customers might one day use these virtual lash makeovers to compare the effect of a new product to their typical mascara look.

Scientists take a digital image of the consumer's original bare lashes.

Then, researchers remove the original lashes, and "draw" virtual lashes that can be manipulated.



This consumer has had her virtual lashes digitally enhanced at a 200% thickness

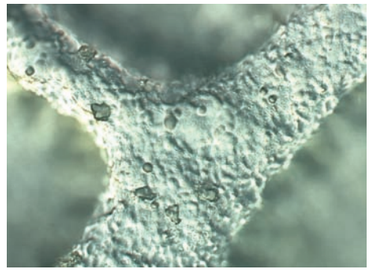
MYTHS & FACTS

- **Most colors of hair dye use the same ingredients.**
  FACT – *Many hair colors use the same dye ingredients, but they are used in different amounts and combinations to create different colors. This is because all natural hair colors are on a continuum of the same shades of color. Even blondes and redheads have a touch of brown, and most brunettes have more than a touch of red.*

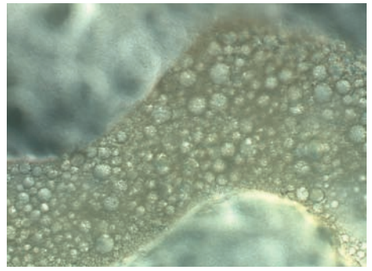
- **Blonde hair dyes are more damaging than other colors.**
  MYTH – *Most of today's permanent hair dyes create similar hair damage profiles no matter what the color. That's because all permanent hair dyes, even darker colors, use a bleaching agent as part of the coloring process. The bleaching agent is responsible for hair damage. While obviously needed for lightening hair color, the bleaching agent is also necessary for darker shades because it removes old hair color that would interfere with the new pigments being added to the hair.*

STRANGELY BEAUTIFUL

P&G Beauty is leading the way in product safety with the development of skin mimic, a tool for testing new ingredients and formulas on a non-living model. Skin mimic is a layered polyurethane material that replicates the skin on your forearm, including pores, wrinkles, and hair follicles. Because the product matches the chemical properties and microscopic bumps and valleys of human skin, it can be used to evaluate products using analytical techniques that would be uncomfortable or invasive for volunteers. The skin mimic surface can even be adjusted to resemble wet or dry skin, different textures, and various pH levels in order to perform many kinds of tests.



A skin mimic "valley" before product application.



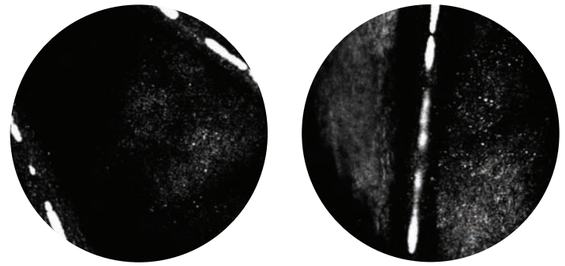
After product application, the skin mimic valley shows researchers how the product might collect along a wrinkle in real skin.

LAB NOTES

Respiratory diseases and diarrhea cause 3.5 million deaths each year among children in developing countries, but simple hand washing with soap can significantly reduce these viral and bacterial threats. Recently, P&G Beauty and its partners in the US Centers for Disease Control and Prevention and the Chinese Center for Disease Control and Prevention completed a school-based hand-washing program in China that reached more than 80 million first-grade students. Compared to the schools that had only routine hygiene training, those schools that received extra instruction by trained personnel, plus antibacterial soap for the school bathrooms, posters, activities, and take-home soap for the pupils, demonstrated reductions in illness rates and incidents of absence by as much as half in the months that followed.

CLOSE UP

P&G Beauty constantly searches for new tools to visualize the benefits of active ingredients. One of the latest, *in vivo* confocal microscopy, provides noninvasive 3-D optical imaging via "virtual sectioning," which describes skin structure as well as spatial distribution of active ingredient particles on the skin and within hair follicles. The use of this technology has helped P&G Beauty scientists develop better antidandruff shampoos because shampoo antifungal activity is directly related to the efficient deposition of pyrithione zinc on the scalp.



1% ZPT 2% ZPT

The white spots in the image on the left show the active deposition from a 1% pyrithione zinc shampoo. The image on the right shows more significant coverage from a 2% pyrithione zinc shampoo.

GLOBAL BEAUTY

Asian women are hooked on a new tool for achieving radiant skin—substrate masks. These masks are different from cream or clay masks because they are more convenient, less messy, and have proven efficacy advantages. P&G Beauty scientists applied a concentrated therapeutic fluid containing niacinamide to a woven cloth-like substrate shaped into a mask. The premoistened mask is placed on the face for 15 minutes and then removed without the need to wash off. Clinical testing shows that the mask significantly increases penetration of niacinamide into the skin—in fact, up to twice as much as the fluid alone. This is because the substrate aids diffusion of niacinamide by preventing fluid evaporation and increasing the local temperature of the skin surface. The result is significantly improved skin hydration, texture, and pigmentation evenness.