

breakthroughs

Science News from P&G Beauty & Grooming

VOL. XX

WHAT'S INSIDE

- 2 CAN GENOMICS HELP SKIN LOOK YOUNGER?**
Genomic testing used in promising new ingredient research
- 3 LASER CAPTURE MICRODISSECTION**
Genomic data analysis improved
- 3 DEFINITIONS TO KNOW**
Genomics vs. genetics, proteomics
- 3 DANDRUFF GENOME UPDATE**
Genomics and biochemical research advancements
- 4 IN THE SPOTLIGHT**
Principal Scientist Rosemarie Osborne
- 4 FAST FORWARD**
Next generation sequencing technology

DID YOU KNOW?

In 2000 when the draft of the human genome sequence was announced, it cost almost \$3 billion and took over 10 years to complete one person's genome. Now, in 2009, a person can have their genome sequenced in less than a month for a cost of only \$48,000. It is estimated that by 2015, this cost will drop below \$1,000.

PUTTING THE GENOME TO WORK IN BEAUTY & GROOMING

One of the greatest scientific achievements of all time occurred in 2000 with the announcement of the completion of the human genome sequence. This impressive feat offered scientists a new tool for attaining their research goals—the field of genomics.

While a person's genome is determined at conception and remains relatively unchanged throughout their lifetime, the genes are constantly activating and inactivating in response to a variety of factors. The insight gained through the analysis of these changes, combined with information gleaned from the sequencing of the human genome, has allowed P&G Beauty & Grooming scientists to identify novel technologies, develop new products and obtain a deeper understanding of human health.

“In order to make products as effective as possible, we need to understand how ingredients affect people at an emotional, physical and, yes, even at the molecular level,” says Jay Tiesman, Principal Scientist.

Genomics, the analysis of gene activity or ‘expression,’ offers insight into how genes function, how they interact with one another, and most importantly when working in beauty, how they respond to environmental stimuli such as topical skin care ingredients.

In contrast to genetics, which only looks at genes in DNA as a static snapshot, genomics looks at all genes as a dynamic system over time, providing a catalogue of gene activity and inactivity under a specific set of conditions. Once a gene is

activated and expressed, it is transcribed into ribonucleic acid (RNA), which ultimately codes it for a protein. These proteins make up the majority of the functional and structural components of cells, which is essential for proper cell function.

P&G Beauty & Grooming envisioned potential applications for genomics research when the field was in its infancy. Since then, the scientists at P&G continue to apply genomics to the fundamental understanding of a variety of consumer issues, including dandruff and skin aging. In fact, P&G scientists have published 40 peer-reviewed articles and given 75 presentations at national and international meetings relating to the field of genomics over the past 10 years.



A P&G Beauty & Grooming scientist inserts the gene chip for analysis.

Gene chips, flexible tools that allow scientists to efficiently analyze gene expression in different types of people, animals, bacteria and even plants, can help scientists monitor the activity of more than 54,000

breakthroughs: Science News from P&G Beauty & Grooming

genes in a single experiment. This allows researchers to efficiently capture vast amounts of information for fast and accurate processing using computation techniques.

Using gene chips to analyze human tissue, P&G Beauty & Grooming scientists have been able to measure

the activity of huge numbers of genes, revealing the entire gene expression profile of a given tissue sample. This catalogued information allows P&G scientists to map the molecular fingerprint, or picture, of a tissue sample and identify key pathways, proteins and lipids to target for treatment.

“Our strategic use of genomics technologies in a variety of research initiatives makes each experiment that we do more efficient and effective,” says Tiesman. “We are now able to give the consumer the best product experience possible.”

CAN GENOMICS HELP SKIN LOOK YOUNGER?

Thanks to the new technologies and tools from the field of genomics, P&G Beauty & Grooming scientists are making great strides toward finding ways to delay the aging process.

In a study presented at the World Congress of Dermatology in 2007, P&G Beauty & Grooming scientists used gene chips to analyze the expression profiles of skin in younger and older women. By comparing these profiles, they identified key molecular pathways that are affected by the aging process.

“For the first time ever, we identified the key biochemical pathways that differentiate young skin from aged skin,” says Rosemarie Osborne, Principal Scientist at P&G Beauty & Grooming. “A key finding is that the skin’s stratum corneum becomes much more fragile as we age. This is important because a healthy, strong stratum is important to allowing maximum inner skin performance.”

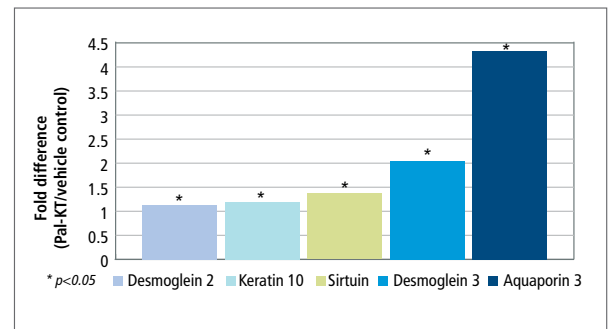
These scientists then applied this molecular understanding of aging skin to identify new topical skin care product ingredients. In addition to further genomic testing, P&G Beauty & Grooming scientists used advanced *in vitro* models of human skin to analyze the effects of new ingredients on gene expression

profiles, biomarker distributions and protein and lipid levels. With these tools in-hand, P&G Beauty & Grooming scientists quickly identified which ingredients are most likely to shift the molecular fingerprint of aged skin towards the molecular fingerprint of younger skin *in vitro*—essentially reversing the aging process.

Promising new ingredients P&G Beauty & Grooming scientists have identified using these techniques include Pal-KT and Hexamidine, as well as optimal combinations of proven anti-aging ingredients.

Once P&G Beauty & Grooming scientists found that Pal-KT, a palmitoyllysine-threonine peptide, was successful at significantly inhibiting collagen breakdown pathways in genomics studies, the researchers began testing human skin models to further confirm the anti-aging benefits of Pal-KT in reducing collagen breakdown.

And as presented at the 2009 American Academy of Dermatology Annual Meeting, through further genomic analyses, Hexamidine was found to restore the underactive lipid biosynthesis pathways in a human skin model. Thus, using this



Human Epidermal Keratinocytes

compound, P&G Beauty & Grooming scientists significantly increased production of lipids such as cholesterol, sphingolipids and fatty acids that have the potential to restore the stratum corneum and moisture content of aging skin.

“Using these genomics tools and human skin cell models, we have achieved new heights in what is possible in skin care, actually returning the performance of older skin to that of younger skin,” says Osborne. “In these skin cell studies we’re effectively reversing the aging process. Understanding the differences between young skin and aged skin at the molecular level, particularly in the stratum corneum, is ultimately helping us to identify approaches that result in more effective anti-aging choices for consumers.”



LASER TECHNOLOGY IMPROVES GENOMIC DATA ANALYSIS

As scientists conduct genomic research to study complex molecular interactions, they often encounter an obstacle—the analyses of genomic data. Because clinical tissue samples are frequently comprised of many different cell types, each with its own repertoire of expressed genes, the genomic data can be difficult to interpret.

P&G Beauty & Grooming has overcome this hurdle by embracing laser capture microdissection, a technique that allows researchers to isolate specific cell types from complex tissue samples. This technology was originally developed by the National Cancer Institute to isolate cancerous cells from non-cancerous cells.

First, P&G Beauty & Grooming scientists identify the cells of interest and place a membrane on them. Then a laser beam is used to attach the membrane to the cells while non-selected cells remain attached

to the microscope slide. The selected cells are extracted from the membrane, and RNA from these cells can be isolated for genomic analysis. This technology allows P&G Beauty & Grooming scientists to explore gene activity, for example, how the skin-related genes function and, more importantly, respond to aging and environmental stress down to the molecular level. P&G Beauty & Grooming's use of advanced research tools, such as laser capture microdissection, ultimately lays the foundation for products that better meet consumer needs.

DEFINITIONS TO KNOW

Genomics vs. Genetics

Genetics is the study of single genes and their effects. Genetics product claims are often associated with the manipulation of DNA.

Genomics, a term coined only 15 years ago, is the study of genes over time as a dynamic system. It allows scientists to analyze gene activity or “expression.” Genomics tells us how genes function, interact with one another, and more importantly, respond to environmental stimuli.

Proteomics

Proteomics is the large-scale study of proteins, particularly their structures and functions. The term proteomics was first coined in 1997 to make an analogy with genomics, the study of the genes over time.

The word “proteome” is a blend of protein and genome. By definition, the proteome is the entire complement of proteins, including the modifications made to a particular set of proteins, produced by an organism or system.

GENOME UPDATE

Genomics and Biochemical Research

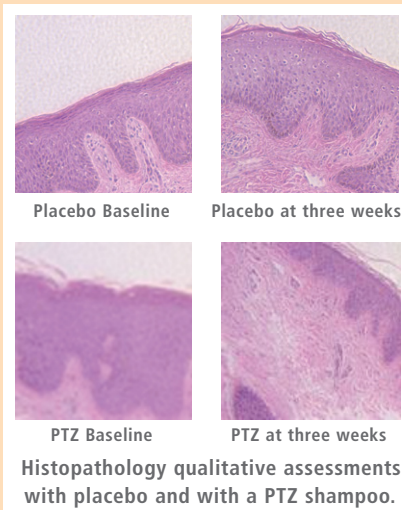
Lead to Advancements in Understanding of Dandruff

With genes generally being expressed as proteins, the fields of genomics and proteomics often work hand-in-hand.

P&G Beauty & Grooming scientists recently advanced the understanding of scalp skin by using protein biomarkers to determine the skin's condition. It is now possible to take a snapshot into the physiology of scalp skin and also investigate the underlying effect of using a potentiated pyrithione zinc (PTZ) shampoo compared to a placebo treatment on Dandruff/Seborrheic Dermatitis (D/SD) affected scalps.

In clinical trials conducted with patients suffering from severe D/SD, patients shampooed with either a PTZ shampoo or a non-medicated, commercially available shampoo. Scalp samples were taken at the start and after three weeks of treatment in order to evaluate the skin's condition and the presence of skin irritation, flaking and other signs of dandruff. In addition, expert graders evaluated the patients' scalps with standard techniques to confirm the correlation between biochemical effects and clinical symptoms.

The results of this study, which were presented at the 2009 American Academy of Dermatology Annual Meeting, showed that the population using PTZ shampoo demonstrated greatly improved scalp skin condition, as shown by the changes in the levels of the biomarkers analyzed. These biochemical findings were consistent with expert evaluations of the significant improvement of the D/SD symptoms in patients using PTZ shampoo.



breakthroughs: Science News from P&G Beauty & Grooming

IN THE SPOTLIGHT

Rosemarie Osborne,
Principal Scientist



As a Principal Scientist at P&G Beauty & Grooming, Rosemarie Osborne utilizes genomics and other approaches to develop *in vitro* models to study skin and hair. Her past efforts

culminated in the development of novel *in vitro* skin and cornea testing methods, which are currently the industry's gold standards for evaluating consumer products and ingredients. More recently, Osborne has begun developing *in vitro* testing methods to bolster P&G Beauty & Grooming's understanding of skin aging.

In addition to co-authoring original articles, book chapters and reviews, Osborne has also presented her scientific findings on *in vitro* methods, animal testing alternatives and skin aging at the Society of Toxicology, the American Academy of Dermatology and the World Congress of Dermatology meetings.

After receiving her Ph.D. in pharmacology from Harvard University, Osborne was a postdoctoral fellow at the CIIT Centers for Health Research, a not-for-profit toxicology institute located in Research Triangle Park, North Carolina.

FAST FORWARD

Advances in Sequencing Technology Propel Research

P&G Beauty & Grooming's 10-year leadership in cutting-edge genomics research has provided their scientists access to the leading technologies and capabilities in the field of beauty and grooming science. Genomic technology allows scientists to analyze gene activity or "expression"—telling us how genes function, interact with one another and respond to external stimuli.

While P&G Beauty & Grooming's genomics team is currently exploring several novel genomics technologies, they are actively working toward the incorporation of digital gene expression profiling, a "next generation sequencing" technology

that will provide even more biological insights—with greater speed, higher accuracy and ultimately, reduced costs compared to current technologies. This will allow scientists to sequence an extensive number of genes at once and provide more information about genes than what is currently available.

Scientists at P&G plan to use this technology in a variety of applications, both in Beauty & Grooming and in other product categories, including Oral Care and Respiratory and Gastrointestinal Health. With the data and knowledge gained through upstream genomics research, P&G Beauty & Grooming will continue to impact the cosmetic industry in new and meaningful ways.

Resources

www.affymetrix.com
(Affymetrix)

www.genome.gov
(National Human Genome Research Institute)

www.aad.org
(American Academy of Dermatology)

P&G Beauty & Grooming Science has more than 1,800 scientists and technical employees working at 16 technical centers with an unparalleled commitment to technology development. Company scientific efforts have resulted in over 10,000 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 Beauty & Grooming products help make beauty dreams real for women worldwide and help men look, feel and be their best every day. With more than 100 brands available in nearly 130 countries, P&G's beauty and grooming products delivered sales of nearly \$28 billion in fiscal year 2007/08, making it one of the world's largest beauty and grooming companies. P&G Beauty & Grooming offers trusted brands with leading technology to meet the full complement of beauty and grooming needs, including Pantene®, Olay®, Head & Shoulders®, Max Factor®, Cover Girl®, DDF®, Frederic Fekkai®, Wellaflex®, Rejoice®, Sebastian Professional®, Herbal Essences®, Koleston®, Clairol Professional®, Nice 'n Easy®, Venus®, Gillette®, SK-II®, Wella Professionals®, Braun® and a leading Prestige Fragrance division that spans from point of market entry consumers to high end luxury with global brands such as Hugo Boss®, Lacoste®, and Christina Aguilera®. (NYSE: PG)

Please visit www.pgbeautyscience.com for the latest news and in-depth information about P&G Beauty & Grooming and its scientific developments.

To talk to a P&G Beauty & Grooming scientist or to learn more about ongoing research at P&G Beauty & Grooming Science, contact:

Heather Cunningham — North America
+1-513-626-2606

Sian Morris — Europe, Middle East and Africa
+44-1784-474776

Dr. Colin D'Silva — Asia and Australia
+65-6824-5383

Mauricio Graciano — Latin America
+52-55-57-24-25-51

Weining Wu — Greater China
+8620-8518-3184



P&G beauty & grooming