

Perspective

From BeadChips to Beauty Counters

How genetic analysis tools are driving innovation in the cosmetics industry.

As genetic analysis technologies continue to mature and expand, the science is finding its way into a growing diversity of industries. From pharmaceuticals to agriculture, and even cosmetics, researchers are applying genomic studies to advance product innovation.

At Procter and Gamble (P&G), a giant in consumer products, Dr. Jay Tiesman is a principal scientist who leads the genomics research team. His group provides genetic analysis resources throughout the company to help product developers understand the molecular basis behind products of interest. The applications touch everything from oral care to respiratory and gastrointestinal care, but far and away the skin care and hair care lines have seen the greatest impact.

By incorporating microarray-based gene expression profiling into their research, scientists like Dr. Tiesman have revolutionized the development of personal care products. Their research has furthered our understanding of the genetics behind processes like skin aging and have led to the discovery of exciting new ingredients.

TRANSFORMING THE DISCOVERY PROCESS

Unlike pharmaceutical companies who typically invent novel therapeutic agents, products developed by “over-the-counter” companies like P&G must rely on substances that have well-established histories of safety and use in humans. Researchers must understand the underlying biology to evaluate how product ingredients can lead

to a desired response.

Without an efficient method to understand how substances impact biological mechanisms, the process of identifying both new ingredients and novel biological targets is slow. As Dr. Tiesman explains, “only ten years ago, understanding how ingredients affected gene expression was like stabbing in the dark. Scientists would often guess at what genes might be involved, relying on standard molecular biology techniques like Northern Blotting to slowly analyze one gene at a time. The advancement of microarray technology has drastically accelerated our ability to learn and discover new ingredients based on that learning.”

Modern microarrays, such as Illumina’s HumanHT-12 Expression BeadChip, enable companies like P&G to evaluate expression levels for tens of thousands of genes simultaneously. With the multi-sample BeadChip format, P&G can quickly evaluate a huge number of compounds to look for exciting new targets and identify new applications for known ingredients. Dr. Tiesman elaborates, “this is the critical part of why we’re very excited about bringing the Illumina capability onboard. Instead of just doing a smaller number of screens, or doing a large number of screens with a small number of genes, we can get into any screening at almost a whole-genome level. Because we can drive the costs down and increase the throughput, we can look at what happens in whole signatures across nearly the entire genome.”



Dr. Jay Tiesman is currently a Principal Scientist at Procter and Gamble, where he leads the Genomics Research team.

As a large consumer product company, P&G also uses high-throughput screening for cross-functional discovery. Because many P&G products interact directly with the epithelium, the company has established a strong expertise in epithelial biology. This expertise helps them to readily identify new applications of known ingredients for use in other product lines dealing with the epithelium. This is the story behind hexamidine, one of the more interesting discoveries from P&G.

FROM BENCH TOP TO BOTTLE

Hexamidine is a common anti-irritation ingredient found in the lotion that lines Pampers baby diapers. Dr. Tiesman and colleagues found that the skin benefits of hexamidine go beyond simply reducing irritation. Using microarray analysis to screen skin samples from women of varying ages, they identified some of the key molecular pathways associated with skin aging. With that knowledge in hand, they screened a number of compounds, including hexaminde, to see if it was possible to reverse some of those aging pathways.

As we age, our skin tends to become drier, which contributes to fine lines, wrinkles, and discoloration. What Dr. Tiesman and his colleagues found was that almost every enzymatic step associated with cholesterol and lipid biosynthesis is down-regulated with age. The application of hexamidine up-regulates these enzymatic processes, resulting in a more functional lipid bilayer and a better moisture barrier for the cells. Enhancing the moisture barrier also affects signaling pathways in deeper layers of the skin, producing additional important anti-aging benefits. These discoveries have been applied in the new Olay Professional Pro-X Hydra Firming Cream. As Dr. Tiesman puts it, “This is where you see the fruits of these genomic studies ultimately going into the bottle.”

NEW AND IMPROVED

The success of hexamidine underscores P&G’s view that new ingredients in products must deliver on their promises. To Dr. Tiesman and his colleagues, the genomic research that goes into their product lines is far from a mere marketing tool designed to convince consumers of the scientific benefit. Rather, the proof is in the results; the effects are scientifically validated, published in peer-reviewed journals, and examined in real clinical studies. When asked what this means for the consumer, Dr. Tiesman replied, “When we say that something is *New and Improved*, it actually is.”

This approach to product development underlies P&G’s strategy to win in the consumer skin care market: provide affordable, accessible results that might otherwise only be achievable in a dermatologists’ office. For example, ingredients in the Olay Pro-X line were found to provide facial anti-aging results that rival the leading prescription retinoid, Vitamin A. The manuscript for this study will soon appear in the *British Journal of Dermatology*.

THE WAY FORWARD FOR MICROARRAYS

With the success microarrays have had driving innovation in the marketplace, it’s interesting to consider how far they have come in such a short time. Dr. Tiesman reflects on when, “popular science was questioning whether these gene expression arrays would give us anything of value. But thanks to good experimental design and outstanding statistical analysis, I’ve seen them become a productive and useful tool for all our work, for the drug discovery industry, and for anyone trying to gain a deep and broad molecular understanding. As with Illumina’s HumanHT-12 BeadChip, I’ve seen the costs for microarray technology come down drastically, which is giving us unprecedented ability to increase our throughput.” He continues, “I think it is im-

“Because we can drive the costs down and increase the throughput, we can look at what happens in whole signatures across nearly the entire genome.”

portant to point out, however, that quality is much more important to us than price. I wouldn't have moved to the Illumina platform if I didn't feel comfortable with the kind of quality that it delivers. When we present our findings, we need to be confident in the quality of our data."

P&G anticipates that the future of skin care is likely to be within diagnostics, making quality even more indispensable. Will there be a day when skin care treatments can be personalized for people based on their genetic disposition? Dr. Tiesman believes so, "I think it is a perfectly legitimate future. It's certainly not the present, though you see quite a bit of snake oil out there. It's something we continue to look at and have a real interest in, but we will only come out with a product if it's scientifically credible."

A development that can further support P&G's efforts is the emergence of next-generation sequencing, which allows researchers to examine gene expression profiles by sequencing RNA samples. "This technology gives us deeper insights and a

more quantitative approach to understanding the gene expression profiling process," explains Dr. Tiesman. Sequencing technology also provides P&G with the ability to study organisms for which microarrays aren't typically developed. Because so many of P&G's products touch the epithelium, microbial and host interactions are of great significance. Through sequencing, they hope to further their understanding of how products can affect the microbium.

Genetic analysis tools have a bright future in the cosmetics and personal care industries, with the potential to transform the products that touch people's lives. Wherever that future leads, scientists like Dr. Tiesman and companies like P&G will be at the forefront of discovery along the way.

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ADDITIONAL INFORMATION

To learn more about Illumina's genetic analysis solutions, please visit www.illumina.com.

We are committed to providing you with the content you want as a member of the Illumina community. Please email us with comments and suggestions for topics at icommunity@illumina.com.

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