

Milestones in Genomics Research and Its Evolution into Skin Care Research

The study of genomics has dramatically evolved; in less than 100 years, scientists have gone from identifying the first human genetic disease to cloning a living mammal. In addition to medical advancements, Genomics has also helped pave the way for skin care research breakthroughs. Procter & Gamble has successfully used breakthrough genomics research and cutting-edge tools to develop highly advanced skin care products and continues to pave the way for future innovations with a deeper understanding of genomics.

1950's: Microbiologists demonstrate the role of DNA in genetic inheritance and identify it as the "transforming agent." James D. Watson and Francis Crick propose the double helix structure of the DNA molecule.

1980's-1990: P&G adopts emerging biotechnology tools to drastically improve molecular understanding of skin aging. DNA cloning, sequencing insights and early gene expression technologies help identify new skin care products.

1990's: Genome projects begin. The yeast genome is complete in 1996 and DNA fingerprinting, gene therapy, and genetically modified foods come onto the scene.

1996: P&G begins using microarray technology, increasing the molecular understanding of skin.

2003: The human genome is reported to be completed; the sequence of the human genome is released, and the "post-genomic era" officially begins.

2003: P&G continues efforts to optimize genomic sample labeling. Efforts confirm the ability to develop high quality data using extremely small samples, including those isolated from plucked hairs, needle biopsies, and even LCM-isolated material.

2005: P&G uses their genomics expertise to study key differences between young and old skin and to gain deeper insight into the photoaging process. Skin samples obtained from these clinical studies are analyzed to develop skin care products.

1997-2000: P&G is an early adopter of GeneChip technology (including Affymetrix GeneChip capabilities). This ultimately becomes the technology of choice for gene expression profiling and is adopted by Big Pharma and hundreds of academic organizations worldwide.

2000 & Beyond: P&G begins experiments in Laser Capture Microdissection (LCM) and acquires a first-generation LCM instrument to improve the labeling of very small samples for genomics studies. P&G continues to expand LCM capability to study skin layer-by-layer and understand how different layers of skin interact and communicate with each other, laying the foundation for products that more effectively address consumer needs.

2001 & Beyond: P&G scientists share genomics data broadly with the scientific community at national and international meetings and publish studies in scientific journals. P&G participates in early international consortia focused on improving genomics data quality.

2007 Scientists from P&G Beauty successfully sequence the complete genome for *Malassezia globosa* (*M. globosa*), a naturally occurring fungus responsible for the onset of dandruff and other skin conditions in humans. Results of the genome sequencing are published in Proceedings of the National Academy of Sciences (PNAS).

2009 & Beyond: The Next Frontier: P&G actively engages in the development and optimization of Next-Generation ("Next-Gen") DNA sequencing technologies to learn more about genes associated with skin aging and how they differ between people. These efforts will enlighten the ultimate frontier for beauty: truly personalized skin care. P&G pioneers application of these Next-Gen capabilities for consumer product applications, providing greater speed and higher accuracy compared to current technologies.

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