

SCIENCE & INDUSTRY

# kosmetikos\*

## To Dye For

Young or older, hair coloring remains a significant personal-care category and “necessity.”

By Steve Herman

*The color you see on my head is not the color that grows out of it. Peroxide is my life partner.*

—Natalia Ilyin

**F**rom today’s teenagers looking for shock value with vivid, multicolored hair, to aging baby boomers hiding their gray, to blue-tinted senior citizens, hair color is a necessity for most. Even those letting their gray show need help to make it the perfect shade—let L’Oréal Gray Chic “celebrate your gray!”

Then there are the blondes...

There are real blondes. Most are four years old or younger. The rest are reindeer ranchers in Iceland. Everyone who appears blonde gets a little help from chemistry, occasionally. Of course, the people with spikes of bright blue and orange hair weren’t born that way either! Natalia Ilyin, in a new book entitled *Blonde Like Me*, devotes 188 pages to the significance of blonde hair as a signal. The

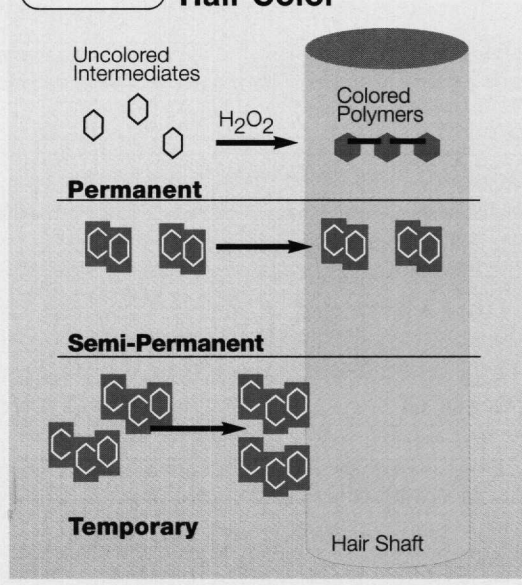
book concludes with a two-page reading group guide, prompting the reader to ponder: “What are we trying to tell the world when we go blonde?” The essence of Ilyin’s book is that blonde is not just another hair color, but a cultural obsession.

The defining molecule for blonde is hydrogen peroxide,  $H_2O_2$ . The great advantage of

*Steve Herman is Director R&D of AFF International. He has 28 years experience in the industry, primarily in fragrance application. He serves as an Adjunct Professor in the FDU Masters in Cosmetic Science program, and has been active in numerous capacities with the SCC. He may be reached at (973) 244-5880, or e-mail: GCISteve@aol.com.*

\*Greek kosmetikos, skilled in adornment or decorating.

FIGURE 1 Types of Hair Color



$H_2O_2$  for bleaching is that after all the available oxygen is released, only water remains. The Paris Exposition of 1867 started the world craze for bleach blondes with “eau de fontaine de jouvence golden.” Peroxide is now sold in solutions identified by volume content, indicating the volumes of available oxygen produced by a given volume of solution. Common drug store peroxide is three to four percent (10 to 12 volumes), and salons can use five to six percent (17 to 20 volumes).

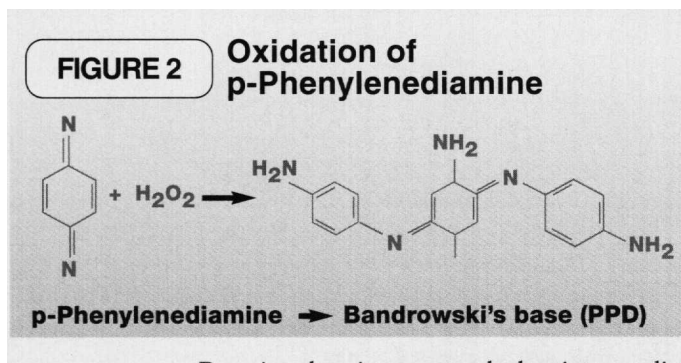
Peroxide can penetrate the hair cuticle and attack the keratin structure. Peroxide bleaches the hair by oxidizing the melanin that is the source of color. Since peroxide has damaging effects, repeated use results in a straw-like appearance. Peroxide is usually activated by a small amount of ammonium hydroxide. Bleached and damaged hair can be dyed easier than virgin hair.

(continued on p. 48)

# kosmetikos\*

(continued from p. 46)

Hair color can be permanent, semi-permanent, or temporary. Permanent color lasts until the hair grows out, semi-permanent lasts through 6 to 12 shampoos, temporary washes out with one shampooing. The chemistry of hair colorants can be reactive or non-reactive.



Reactive chemistry uses colorless intermediates, that are oxidized by hydrogen peroxide to produce color. Non-reactive chemistry is similar to the application of a pigment.

Figure 1 shows the basic mechanisms of hair coloring. Permanent dyes begin as small, uncolored intermediates, which can penetrate the hair shaft. Neutralization follows, producing a colored polymer trapped inside the hair. The process where the intermediate is polymerized by peroxide defines this as a reactive process. The other coloring processes, semi-permanent and temporary, do not change the color molecule, and thus are termed non-reactive.

Bandrowski's base, made from p-phenylenediamine (PPD), is the basic skeleton used for creating numerous permanent colors (Figure 2). The base shows the chemical structures common for colored molecules: conjugated double bonds and nitrogen. Slight variations in this structure produce different shades. The couplers, typically primary amines and/or hydroxy groups in the ortho or para positions, are the key to precise shade modification. For example, PPD with 4-amino-m-cresol results in a medium golden brown, while PPD with 1-naphthol yields a dark violet. Of course, the initial hair color strongly affects the color results after dyeing.

The components of the developer and dye intermediate perform multiple functions. The oxidant in the developer destroys the melanin in the hair: The bleaching effect allows the dyed hair to be lighter than the natural hair.

The oxidant then polymerizes the dye intermediate. The alkaline nature of the dye intermediate allows it to swell hair, aiding the dye penetration, and then destabilizes the  $H_2O_2$  to provide oxygen.

The punk look, or "party shades," can be represented by the product line of Manic Panic ([www.manicpanic.com](http://www.manicpanic.com)). A recent offering is Electric Lava, which makes hair glow under black light. The Manic Panic dyes are semi-permanent, and are available as liquids or gels. The colors are best used on light, bleached hair, and shampoo out with a single washing.

Eyebrows and eyelashes cannot be dyed, as skin irritation is too great, but beards and mustaches can. Just For Men hit the aging male population with a highly successful gel formula. Grecian Formula was the old standard for men's hair coloring, with a formula based on lead acetate, a progressive hair dye applied over time to produce a gradual coloring effect. Lead is a hazardous substance, but the FDA is convinced lead acetate is not absorbed into the body or bloodstream under proper conditions of use. Safety issues are a major concern of hair dyes. They are without doubt irritants, and every product comes with instructions for proper use. The FDA's position on hair dye safety can be found at [www.fda.gov](http://www.fda.gov).

Bleach and hair dye are important for large segments of society for a variety of reasons. Blondes send a social signal, the aging population looks younger, youth can rebel. No personal-care category allows more people to change their appearance, and feel better about themselves in the process, than hair colorants. ■

## References

- A valuable company guide is *Keystone Aniline Corporation, Technical Guide and Formulary*.
- Brown, Keith C. and Pohl, Stanley, *Permanent Hair Dyes*, SCC Monograph, 1996.
- Burmeister, Fred, *The Chemistry of Hair Coloring Products*, presented to FDU Hair Care Laboratory, 9/27/98.
- Corbett, John F., *Hair Coloring Processes*, C&T, Vol. 106, July 1991.
- Ilyin, Natalia, *Blonde Like Me: The Roots of the Blonde Myth in Our Culture*, Simon & Schuster, 2000.
- Wall, Florence E., *Bleaches, Hair Colorings, and Dye Removers*, in Balsam, M.S., and Sagarin, Edward, eds, *Cosmetics Science and Technology*, 2nd Edition, Wiley-Interscience, 1972.