



# CHEMICAL REACTION BY STEVE HERMAN

## Let There Be Light

Cosmetics based on optical effects don't enhance skin health at a fundamental level, but they make skin look better, and that is not a negligible achievement.

"Darkness cannot drive out darkness; only light can do that."

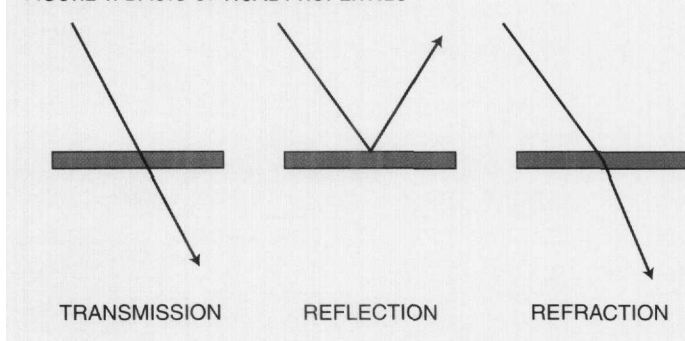
—Martin Luther King, Jr.

PERFECT SKIN has become the ultimate goal for many consumers of treatment products. Cosmetics are far from the only option: exercise, diets, shots of Botox or collagen injections, and nutritional supplements all vie for attention. In addition, more aggressive approaches are available such as laser surgery, face lifts and chemical peels.

The world is full of baby boomers now in their fifties who want to look twenty, and they are willing to do anything it takes to turn back the clock. Skin care products at department stores hit \$1.8 billion in 2001, but they can be pricey. Chanel's Age Delay retails for \$85 for a 1.7 ounce bottle. The fastest market growth is from drugstores, supermarkets and discounters, where the \$3.6 billion in sales for 2001 was a 7.6 percent increase over 2000.

A more modest approach is simply to make skin appear

FIGURE 1. BASIC OPTICAL PROPERTIES



healthier and younger, for ancient wisdom holds that "beauty is in the eye of the beholder."<sup>1</sup> The typical biochemical ingredients used in skin care to improve appearance range from alpha hydroxy acids to botanical extracts and are, in addition to a variety of other claims, meant to reduce skin texture and roughness. But what hits the eye of the beholder is light, and controlling optical properties is a new key to looking younger. Optical methods make no substantive changes to the skin but when the technology is applied to cosmetics they can temporarily modify the appearance of a variety of conditions including wrinkles, cellulite, large pores, scars and discoloration associated with veins and arteries.

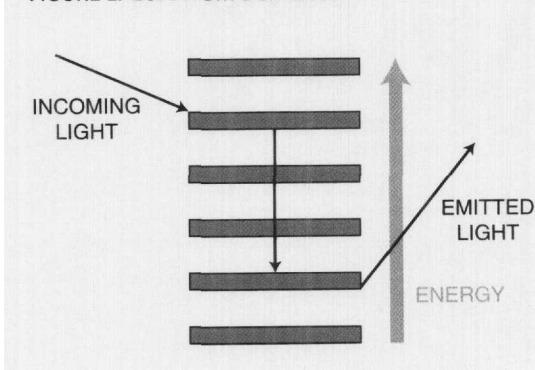
The properties of light can be best understood sometimes by illustrating light in waves and at other times as particles. The

wave theory is older and forms the basis of classical optics. The particle view, where light consists of discrete particles of energy, was codified in quantum theory. Both the wave and particle nature of light are essential for understanding the cosmetic applications of optical effects.

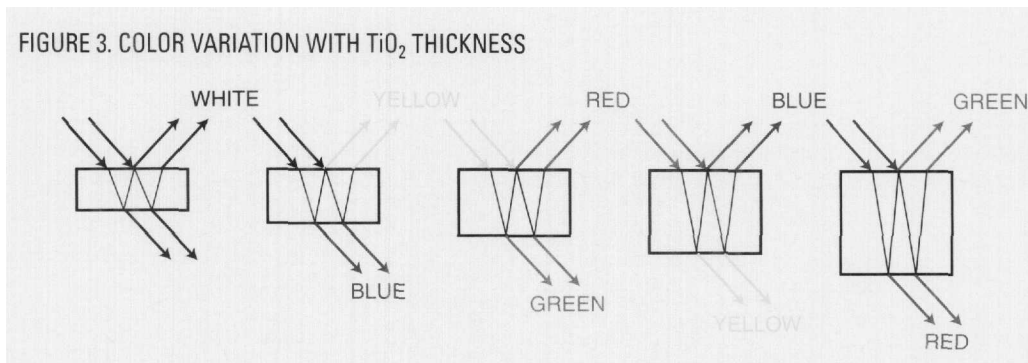
When light passes from one medium to another, a variety of effects is possible. It can pass through without change—called transmission, bounce back in reflection, or refract or bend. These possibilities are shown in Figure 1 and are best explained by thinking of light as a wave, with its velocity affected by the change of media.

When incoming light is re-emitted at a different wavelength, it is easiest to view light as particles. With quantum restraints on the energy of light at a given frequency and the possible energy levels of electrons in the atom, only specific

FIGURE 2. QUANTUM BEHAVIOR



Using optical brighteners in cosmetics creates the illusion of youthful, healthy-looking skin.



interactions are possible, as shown in Figure 2. One of the prominent applications of the quantum interactions of light is the functional basis for chemical sunscreens, where harmful UV light is re-emitted as heat and harmless visible light.<sup>2</sup> Another example is fluorescence, where objects glow in response to incoming energy.

Pearlescent pigments provide a dramatic example of multiple reflections. These pigments are typically mica platelets coated by a thin layer of titanium dioxide or iron oxides. Reflection from many layers of platelets

creates delightful visual effects, which vary with the thickness of the coating on the surface of mica particles. The reflected and transmitted colors are shown in Figure 3.

One of the oldest methods of concealing wrinkles and other skin imperfections is the use of skin-toned face powders and makeup. These products essentially fill in the cracks, as shown in Figure 4a. The effect is crude, as it does not allow any of the natural glow of the skin to shine through, and it is a passive rather than an active technology. It also does not help a number of common problems, such as the bumpiness associated with cellulite.

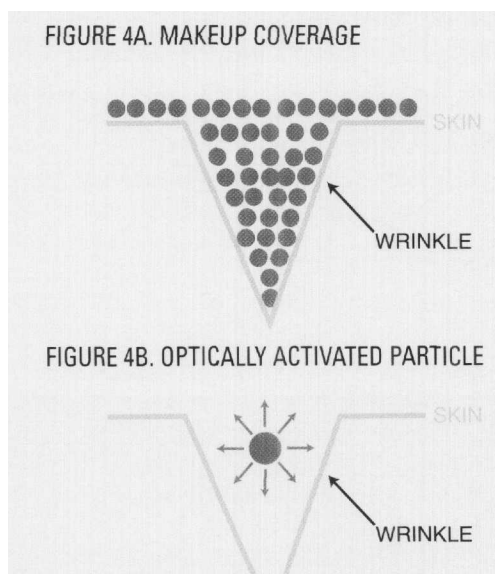
The latest approach to controlling light is to use invisible—smaller-than-perceivable—particles to reflect and emit visible light from wrinkles and other distressed areas. Using such particles in a cosmetic can reduce the appearance of a wide variety of skin conditions. Figure 4b shows its potential ability to hide wrinkles. An example of this new technology is available from Lipo under the trade name LipoLight™ OAP/C.

The literature on optical effects is sparse: Emmert con-

sidered the soft-focus effect<sup>3</sup> and Desmarthon et al. looked at light diffusing in makeup.<sup>4</sup> Desmarthon concentrated particular attention to the valuable optical properties of nylon-6. Boron nitride, as supplied by Advanced Ceramics Corporation, has been one of the few materials promoted for its soft-focus effect.<sup>5</sup>

Optical brighteners have been used in laundry products for many years. Applying the same technology to cosmetics—and using all the accumulated knowledge of the relationship between light and skin appearance—leads to a particle that can both reflect and emit light.

The new technology does not cover the problem area with a layer of relatively inert material, but rather contributes light to the surface that effectively removes shadows and consequently yields healthy-looking skin. It can be as effective on the relatively smooth hills of cellulite as it is on the sharp indentations of wrinkles or the deep shadowing of enlarged pores. Since it does not depend on physically filling the problem areas, it can be delivered in a variety of cosmetic vehicles. As a clearly valuable addition to the arsenal of the cosmetic for-



mulator, it will unquestionably become an important formulating tool in the near future.

Cosmetics based on optical effects don't enhance skin health at a fundamental level, but they make skin look better, and that is not a negligible achievement. In addition, the use of optical ingredients is highly non-evasive compared to other treatments and, thus, singularly safe. Using just one product, a variety of problems can be alleviated—a range not matched by any other treatment method. Eternal youth is not achieved, but it is a giant step toward creating the illusion of youth.

One last thought ... a study by psychologist David Weeks<sup>6</sup> showed that lovemaking boosts hormones that "reduce fatty tissue and increase lean muscle, giving a more youthful appearance." With all the options, there seems to be no excuse left to allow the visible signs of aging to creep up on anyone. **GCI**

#### References

Thanks to Bruce H. Victor of Lipo for valuable information on light-diffusing technology

- 1 "Beauty is in the eye of the beholder" is a paraphrase of a rather lengthy statement in Plato's Symposium
- 2 Kosmetikos, Quantum Chemistry, *DCI*, June 1999
- 3 Emmert R, "Quantification of the Soft Focus

Effect," *Cosmetics & Toiletries*, 111, No. 7, July 1996

- 4 Desmarthon E et al., "A Light Diffusing Concept for Antiaging Effects in Makeup Formulations," *Cosmetics & Toiletries*, 117, No. 1, Jan. 2002
- 5 [www.atalink.co.uk/csb2000/html/art\\_rawmats\\_advceramics.htm](http://www.atalink.co.uk/csb2000/html/art_rawmats_advceramics.htm)
- 6 *Readers Digest*, October 2001

Note: Weeks and coauthor Jamie James originally reported their work in the book *Secrets of the Superyoung: The Scientific Reasons Some People Look Ten Years Younger Than They Really Are—And How You Can, Too*, Villard Books, 1999

Steve Herman is vice president, new technology development, at AFF International. He has more than 30 years of 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. 973-244-5880, [gcisteve@aol.com](mailto:gcisteve@aol.com)

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