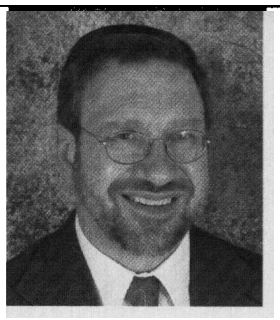


In Search of Eternal Youth

The next few years may witness the greatest shift in anti-aging technology in history. BY STEVE HERMAN

I am not ageless:
my youth is gone.
Red-robed Dawn,
immortal goddess,
carried Tithonus
to earth's end
Yet age seized him
despite the gift from his
immortal lover.

–Sappho, Fragment 58

EOS, the goddess of dawn, loved a mortal, Tithonus. She asked Zeus to make Tithonus immortal, and the wish was granted—but she forgot to include eternal youth in the bargain. Tithonus indeed lived on and on, but he withered away to a decrepit and shriveled old man. Finally, Eos ended his misery by transforming him into a grasshopper. Living forever, without controlling the ravages of aging, is not a blessing.

Anti-aging products are the hottest commodities in skin treatment, but the ultimate causes of aging cannot be halted—much less reversed—by retinoids, a few free radical scavengers, and UV absorbers. The modern understanding of the fundamental aging processes creates the possibility of boundless progress in the development of fundamentally superior new products, but the technical challenges are imposing.

There are four major theories on the basic causes of aging. The "Wear and Tear" theory maintains that toxins in our diet and environment wear down the body, with the damage augmented by the sun's ultraviolet rays, plus physical and emotional stress. The "Neuroendocrine Theory" states that in our youth, various hormonal systems and organs work to regulate body functions. As we age, the body produces lower levels of hormones, which has disastrous effects on our functioning. The "Genetic Control Theory" claims our DNA is genetically programmed to self-destruct once we've completed our biological mission of having children. The "Free-Radical Theory" says healthy cells are destroyed by extensive damage triggered primarily by exposure to the sun.

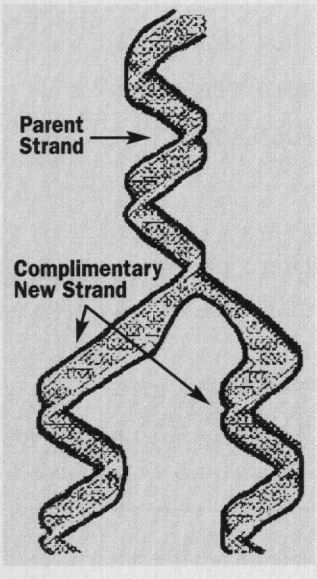
For decades, biologists have known the body's mortality is mirrored on the cellular level by an immutable rule called the Hayflick Limit. Dr. Leonard Hayflick, now of the University of California, San Francisco, discovered that when tissue cells taken from the body are cultured, they reproduce about 50 times and then lapse into senescence. The ends of the DNA chains fray like shoelaces during each replication, until the damaged ends are long enough to destroy the genetic message.

Figure 1 shows the double helix structure of DNA. The two chains are held together by the four bases, adenine (A), guanine (G), cytosine (C), and thymine (T). The only base pairings that are possible are A-T and G-C. Telomeres are composed of repetitive DNA sequences at the end of the chromosomes. Humans have 46 chromosomes and, thus, 92 telomeres (one at each end). Human telomeres contain thousands of repeat units of the six nucleotide sequence, TTAGGG. A simple schematic of the relation of the telomere to centomere is shown in Figure 2 on p. 16.

The Hayflick Limit likely has its roots in evolution. Each time DNA replicates, the possibility of mutation occurs. Not every mutation is fatal, but a series of replications is likely to eventually produce an undesirable cell. The Hayflick Limit does not control all DNA: Viruses, stem cells, and reproductive cells are examples that repair the ends after replication. Blood stem cells reside in the bone marrow of children and adults, and can be found in small numbers circulating in the blood stream. Blood stem cells perform the critical role of continually replenishing our supply of blood cells throughout life.

The fundamental aging process is not taking place in the top layers of the >>>>

FIGURE 1: DNA REPRODUCTION



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The next few years may witness the greatest shift in anti-aging technology in history.

skin but below the surface in the dermis. The loss of dermal mass with age, and the resulting loss of elasticity and thickness, is the most obvious indicator of skin aging. Most preliminary testing of treatment products has been conducted on animal skin. The more specific the technological approach, the more important it is to use human skin. The recent cloning of rhesus monkeys does bring us closer to a potentially more accurate test matrix. Since fundamental biological processes may be influenced, this will require careful test protocols.

FIGURE 2: A SIMPLE RELATION

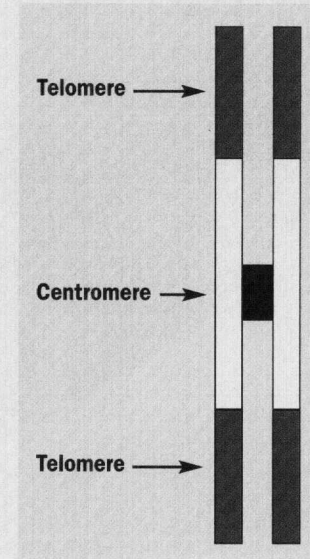
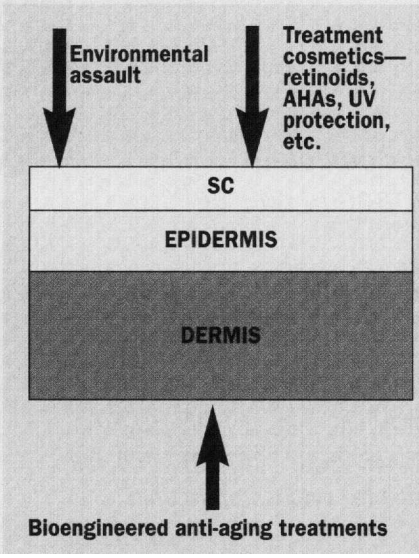


FIGURE 3: THE FUTURE OF SKIN CARE?



The aging of skin involves many factors, with hormones, fibroblasts, and Langerhans cells being prominent. Chemical signaling may be as important in the changes relating to aging as the Hayflick Limit. The number of cells and processes influencing the degradation of the skin may provide a more complex challenge to researchers than those faced in the conquest of cancer.

The next few years may witness the greatest shift in anti-aging technology in history. In cosmetics, from Galen to the present will be viewed as a progression lacking a true revolution, actives such as retinoids and AHAs being the furthest frontiers of the old era. Currently, the potential treatments arising from the genome project are rightly directed at the top priorities, such as cancer, AIDS, and Alzheimer's. Technology is moving with blinding speed in the biotechnology arena, and the lessons learned in treating serious diseases may make child's play of conquering the visible aspects of aging. Of course, these new treatments will be drugs that will make our most cutting-edge cosmeceuticals seem little better than a dab of petrolatum.

The not-too-distant future may offer consumers the scenario in Figure 3. Treatment cosmetics will handle environmental assault on the skin, primarily from free radicals and the sun. The new anti-aging regimens, derived from the fruits of the genome project, will deal with the fundamental causes of skin aging from the inside. When the new era of genetically driven therapy comes to maturity, a modern Eos will not need the intervention of Zeus to give her lover immortality and eternal youth. The genome contains the ultimate key to youthful skin—to enclose the rejuvenated body created by other wondrous applications of biotechnology. GCI

References

There are hundreds of Internet references on aging, the genome projects, telomeres, cloning, and bioengineering.

The Aging Research Centre at http://www.arclab.org/ is a good place to start.

http://www.agera.com/anti.htm has "Anti-Aging Skincare Products and Cell Culture Testing of Potentially Active Agents" by Don R. Owen, Ph.D., and Lili Fan, M.D.

A good introduction to telomeres can be found at: http://www.swmed.edu/home_pages/cellbio/shay/FAQ.2000.htm.

Steve Herman is director of R&D of 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. He may be reached at (973) 244-5880, or by e-mail: GCISteve@aol.com.