How Environment and Lifestyle Choices Influence the Aging Process

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Differences in the physical appearance of identical twins attributable to aging were studied. Because these individuals are identical genetically, any differences found were believed to result from external factors. Twins showing the greatest discrepancies in visible aging signs also had the greatest degree of discordance between personal lifestyle choices and habits. The most notable exogenous factors influencing degree of aging were sun exposure and smoking. Other possibly contributory lifestyle factors include alcohol consumption, stress, diet, exercise, disease, and medication. In summary, the genetic influences on aging may be highly overrated, with lifestyle choices exerting far more important effects on physical aging.

Antell DE, Taczanowski EM. How environment and lifestyle choices influence the aging process. Ann Plast Surg 1999;43:585–588

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Received Jul 6, 1999. Accepted for publication Jul 10, 1999.

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Of all the people who have lived to age 65 years, more than half are alive now. The average life expectancy has lengthened more in the past 100 years than in the preceding 2,000 years. Ancient Romans lived an average of 22 years. In 1900, the average life span was 47, but today the average man lives to be 72 years old and the average woman lives to 79.[1]

Why do we age? Why do our bodies decline with age? Why does one person age more quickly than another? Is there anything we can do? Four primary theories have been proposed to explain aging's biological mechanisms, as follows[2]:

1. The cellular wear-and-tear theory, which states that overuse and abuse accumulates biochemical damage in tissues and organs, leading to failure
2. The free radical theory, which proposes that the normal waste products of cellular metabolism damage progressively the deoxyribonucleic acid (DNA) required to maintain and repair cells
3. The neuroendocrine theory, which focuses on the need for normal hormonal function to monitor and to preserve cellular function
4. The programmed cell death or genetic control theory, which views the life span as preprogrammed and coded in each person's DNA, except for cancer and germ cells

None of these theories account fully for the changes seen with aging. For example, growth hormone levels drop with age but can be supplemented to improve memory, immune function, strength, skin tone, circulation, and fat distribution. However, no evidence ascribes antiaging benefits to hormone supplementation. In fact, many men who took growth hormone developed side effects such as carpal tunnel syndrome, diabetic symptoms, and breast growth.[1] Because no current evidence supports any one theory as the sole mechanism for aging, aging's biological changes probably result from the interaction of multiple factors.[2]

A good facelift lasts forever. If you had an identical twin and you had a facelift but your twin did not, you would always look 8 to 10 years younger—but you would both continue to age. This study attempts to prove that you can practice "defensive aging" behaviors and control the severity of the damage aging produces naturally. Thus people may be more in control of the speed and degree of aging than is currently thought.

Physiologically, aging can be defined as the gradual and progressive decline of every organ system, usually evident by the third decade of life.[2] The rate and extent of decline vary from individual to individual and independently within each organ system. As organs age, many exogenous factors (such as diet, environment, and personal habits) as well as genetic factors produce effects. As the genetic control theory states, each of us is born with a unique genetic code that determines the type and duration of our physical and mental functioning. The human body is thus a machine that is preprogrammed to self-destruct at a particular time, within a range of a few years. When the self-

destruct sequence is complete, our bodies begin to age and eventually die.[3]

Unfortunately, access to genetic influences on aging is beyond our reach. To focus on factors that *can* be controlled, this study has attempted to eliminate genetic predisposition as a variable by assessing only identical twins. Because identical, or monozygotic, twins arise from a single fertilized ovum and have identical genes, they can be considered clones with regard to genetic makeup, and thereby provide the opportunity to compare qualities.[3] Both members of a set of identical twins should be preprogrammed to age identically, but this study shows that, based solely on facial appearance, this is not the case. For various reasons, close examination of the twins, although they still appear "identical," shows that one twin looks like an older version of his or her counterpart.

Methods

Data were collected and photographs taken of 34 sets of identical twins (68 individuals) ranging in age from 45 to 75 years. Zygosity was 96% accurate as determined by a monozygous questionnaire[4] that each twin completed. Comparisons were also made with respect to appearance and lifestyle.

Of the 34 sets studied, 7 sets (14 individuals) were compared for histological skin differences. Monozygosity was determined by genetic marker matches taken from blood samples. A 0.5-cm-diameter disk of preauricular skin was examined microscopically and analyzed by the same dermatopathologist for thickness, elastin/collagen distribution and ratio, and solar exposure-related changes. Data collected from an extensive questionnaire allowed for comparison of lifestyle and personal habits—specifically, sun exposure, tobacco use, exposure to secondhand smoke, use of medications, health history, alcohol consumption, diet, exercise, and stress.

Results

In all twins the wrinkle patterns and hereditary blepharoptosis were identical, but the depth and severity of wrinkles, amount of excess skin, and quality of skin texture varied. Each variable differed in direct proportion to the relative differences in lifestyle within that twin set. One set of 60-year-old white male twins had a marked discrepancy in the amount of gray hair each sported. With no other variances in lifestyle or environmental factors, the differences appeared to be related to smoking. The twin with a 40-year history of smoking a pack a day had more gray hair (approximately 50% more) than his brother who never smoked. The facts of their lives other than the smoking were virtually identical, with both attending the same university, both living in the same home, and both working as partners in their own firm.

The least amount of appreciable difference in the visible signs of aging was seen in twin 64-year-old Mennonite women from Ohio who lived virtually identical, vice-free lives. The only differences noted were that one twin is approximately 3.6 kg lighter than her sister, has hypothyroidism, and takes Synthroid daily.

The most dramatic example of the effects of nature versus nurture can be seen in Figures A and B. Photographs of these white, female identical twins, age 59 years, could easily pass for before and after images of the same facelift patient. Under microscopic examination, the older-appearing twin shows more solar elastosis than her sister and has larger pores. The differences in gross appearance may be related to the older-appearing twin's lifestyle/environment, which includes marijuana use, cigarette smoking, alcohol use, substantial sun exposure on California beaches, avoidance of red meat for the past 40 years, and treatment for depression. She also suffers from hypertension, controlled by a beta blocker, whereas her sister does not. Twin A (the older-appearing twin) was the first born and was heavier than twin B by 0.45 kg at birth. She currently weighs 2.72 kg more than her twin.

Discussion

This study has shown that, without regard for genetic influences, environmental and lifestyle factors can accelerate the aging process as measured by physical appearance. The factors exerting the greatest influence seem to be substance or

(A, B) Twins, age 59 years, who could pass for before-and-after images of the same facelift patient. Note especially the greater depth of wrinkling and larger pore size of twin A (A) compared with twin B (B).

alcohol abuse, sun exposure, and emotional stress. How can these effects be produced?

Environmental and lifestyle factors can influence the length and health status of a person's life. For example, restricting caloric intake and maintaining proper nutrition lead to a substantially longer, healthier life. Severe caloric cuts can lengthen the life span of mice by 50%.[1] Among the biomarkers of health improved by calorie restriction are hypertension, cholesterol level, percentage of body fat, heart rate, and blood sugar levels.[5] Some lifestyle choices produce undesirable effects on health, such as smoking, overexposure to sunlight, and stress. Smoking can cause decreased hearing sensitivity (due to cochlear damage, adverse effects on hair cells, antioxidant mechanisms, or damage to the vessels supplying the auditory system)[6] and decreased circulation to the face, producing a yellowed skin tone and inhibiting the transport of nutrients, leading to collagen breakdown and increased wrinkling.[7] In addition, more than 90% of the sin damage seen today is produced by sun exposure. The effects, which result from exposure some 20 years earlier, include significant degradation of collagen and elastin, which produces wrinkles and sagging, large pores, loss of elasticity, uneven pigmentation, abnormally rapid melanocyte maturation, precancerous cells, age spots, and skin cancer.[8]

A study being conducted by Snowdon of the University of Kentucky focuses on nuns and seeks to evaluate genetic influences while controlling for environmental factors.[1] "The convent is a perfect place to study aging," he says, "because all the nuns have such similar backgrounds. All have spent their years eating similar food, getting similar educations, and working similar careers, while shunning cigarettes, alcohol, marriage, and childbearing."[1,p.11] A study in Baltimore is following more than 1,100 people year after year as they age.[1] Participants return

every 2 years for 2.5 days of medical and psychological tests to track the aging process. Conclusions are not yet available, but should shed additional light on the nurture versus nature controversy.

The quality and length of our lives depend much more on behavioral factors than on genetics or disease, according to 10 years of study by Kahn and Rowe.[8] Our current twin study has shown that, when controlling for the effects of genetic predisposition, lifestyle can greatly influence a person's physical appearance and augment the effects of aging.

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