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The New Face of Aging

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"Live long and prosper"
Mr. Spock, *Star Trek*

Like it or not, we are living longer. Better nutrition, health care, vaccination, public and residential disinfection, and waste treatment have essentially eradicated mortality as a consequence of the acute and childhood diseases that once ravaged humanity. The result is that aging is becoming a global issue, with the older populations of most countries--even developing ones--growing faster than their overall populations. By the year 2030, when America's "Baby Boomers" are in full retirement. almost 20%
of the nation's population, or more than 70-million people, will be past the age of 65.

Among the foregoing changes in demographics, one of the most interesting is that percentage-wise, the fastest growing age group of Americans are those over the age of 100. By 2030, there will be 324,000 Americans 100 and older, and by 2050 that number will double (1).

Encouraging though they may seem, however, such data harbor inherent problems. Living well past our biologic reproductive prime has brought a plethora of geriatric consequences, from changes in lifestyle and disability management to burdens on the healthcare system, public transportation, and government finances.

Another problem resides in our thinking. Whereas a century ago it was thought "normal" to succumb to injury or acute disease, and the average lifespan was into one's late forties, we no longer accept even age-related disabilities as normal. As we move toward an era of preventing functional disability and extending our healthy years, we need to liberate our attitude toward aging and what it means in today's society. We need to become more familiar with what it means to **"live long and die short."**

Hormonal Imbalance and the Spiral of Aging

As we enter the new millennium, with its changing attitudes toward aging, growing numbers of people are seeking to prevent or treat age-related debilitation through knowledge, changes in nutrition, dietary supplementation, exercise, and in other ways. Many are adopting strategies for avoiding the chronic diseases that might otherwise overtake them. Those aged 40 to 70 years are concerned mainly with the accumulation of daily discomforts and disabilities that threaten to intrude on their lifestyle. They may simply term these ailments--often consisting of cartilage and bone loss, enlargement of the prostate and heart, obesity, diminished immunity and libido, sleep disorders, and depression--"lack of energy." Only subconsciously are they aware that the symptoms of "getting on," with such attendant chronic diseases as osteoarthritis, cardiovascular disease, diabetes, and cancer, derive from a lack of energy at the cellular level. More specifically, the aging-related decline in quality of life stems primarily from hormonal imbalances that progressively reduce

cellular functionality. To move beyond the resigned acceptance of geriatric illness into the territory of its effective prevention and management, we need to first understand that the cellular physiology of aging is coordinated by hormonal regulatory dysfunction affecting the entire body.

To maintain functionality at relatively youthful levels, the body must continually synthesize cellular components, particularly proteins, to replace those that are consumed, modified, or become damaged--a process that requires energy. The survival of each cell in the body depends upon its individual ability to generate energy from food. To perform this vital anabolic process, the mitochondria within each cell must transform the energy in foodstuffs into a constant supply of cellular energy. The mitochondria accomplish this through the process of oxidizing fatty acids and carbohydrates to create the energy-storing compound adenosine triphosphate (ATP).

The Hormonal Role in Cellular Energy

In order to properly maintain their membranes and their various functions, including the electron transport system by which they generate energy directly and in the form of ATP, mitochondria depend both on the structural integrity of the cell that contains them and on adequate cell signaling and hormonal stimulation.

Yet as humans move beyond their reproductive years, the secretion of various hormones becomes desynchronized, producing hormonal imbalances that help send the body into the deteriorating self-propagating spiral of deterioration and aging. Among the hormones whose declining functionality or levels contribute to the aging process are estrogen, testosterone, insulin, dehydroepiandtrosterone (DHEA), melatonin, and human growth hormone (hGH). Of all of these, however, it is a decline in levels of hGH that appears to most directly and significantly affect mitochondrial energy production.

The decline in hGH reduces both the lipid content of mitochondrial membranes and the cell's ability to transport fatty acids. The result is a progressive loss of cell-structural integrity and reduced ability to manufacture ATP. The latter in turn reduces anabolic metabolism and the synthesis of cellular components, iun addition to attenuating various cell-regulatory mechanisms. Outwardly, there is a progressive loss of physical energy; increased deposition of abdominal fat leading to obesity; body wasting with a reduced lean body mass; reduction in bone mass and cartilage, culminating in osteoporosis and other degenerative diseases; increased risk of cellular hypertrophy causing prostatic and cardiac enlargement; and an increased likelihood of cell proliferation, leading to cancer.

Counteracting Functional Decline

Braking the aging process therefore depends both on treating it as a deficiency disease in which nutrients must be rebalanced with one another and effectively utilized through continuing exercise, and curbing the hormonal decline that ends in the debilities of aging. Just as adding rocket fuel to an old car will not make it run like new, accomplishing this requires a deep overhaul.

The supplemental administration of acetyl-L-carnitine or hGH can restore cellular energy production (2-6). Metabolic derivatives of L-carnitine partake in the transport of fatty acids into mitochondria for both oxidative metabolism and the construction of membrane-stabilizing components. hGH and thyroid hormones counteract the age-related dampening of mitochondrial energy metabolism and promote mitochondrial proliferation, increasing the intracellular numbers of these energy-producing organelles without the need for cell division. hGH plays critical roles in metabolism, muscle mass, lean/fat body composition, bone turnover, immune capacity, exercise function, reproductive function and sleep patterns during adulthood (2). It has been shown to increase lean body mass, decrease body fat, and increase treadmill work output, functional

performance, and quality of life (7,8). The effect of exogenous hGH in counteracting loss of body mass is so great that it led the FDA in 1996 to approve use of the hormone for treating body wasting in HIV-infected patients.

A Natural Approach to Hormone Restor-ation

Although it increases overall plasma levels of hGH, sometimes with dramatic effect, subcutaneous administration of the hormone, as widely used in clinical practice, is not physiologically ideal. This is because bolus injection of hGH does not reproduce the natural pattern in which the pituitary normally secretes hGH in small pulses every 3 hours throughout the night and day. Moreover, bolus injection of hGH can have undesirable side effects. Therefore, a much preferred and more natural approach is to increase the endogenous release of stored hGH by stimulating the pituitary. Amplifying pituitary secretion of the hormone with secretagogues that specifically exert this effect has been proven to be therapeutically valid. Additionally, secretagogues of hGH have been shown to improve sleep patterns in a manner similar to that of melatonin, apparently promoting circadian patterns of sleep and daily circadian rhythms.

GH secretagogues are synthetic compounds now undergoing clinical trials and testing by large pharmaceutical companies. They are currently available only for experimental clinical use. However, commercially available nutraceuticals that can reportedly stimulate release of hGH, although not validated, can be found on the Internet at World Health Online (12). Moreover, the effects of stimulating hGH release are well documented (13). Notably, it has been reported that administration of either acetyl-L-carnitine or another readily available amino acid L-ornithine, can stimulate pulsatile release of hGH via a whole-body feedback mechanism (9). If and when fully validated, this approach may revolutionize the ability to restore levels of hGH.

DHEA

Of the various steroid hormones made by the body, dehydroepiandrosterone (DHEA) is considered the "mother" hormone because the body makes it directly from cholesterol in the adrenal glands, and then converts this DHEA on demand into other hormones including the anabolic and sex hormones such as estrogen, progesterone, testosterone, and androstenedione. In parallel with hGH, DHEA peaks at about 25 years of age and declines thereafter. Among the various hormones whose levels and function decline with aging, both DHEA and hGH, as well as melatonin, decline exponentially, at a rate of 7 to 10% per decade, between the ages of 25 and 80 (10).

Study data strongly show that supplementation with DHEA replenishes the body's general steroid metabolism and can alleviate cellular insulin insensitivity (11). Supplementation with DHEA shows no harmful side effects and contributes positively to the anabolic status of the body, improving immune function and reducing the risk of cardiovascular disease, osteoporosis, and neural disorders.

Melatonin

As noted earlier, melatonin is another hormone that undergoes a steep age-related decline similar to that of hGH and DHEA, its secretion being greatest very early in life and lowest in old age (10). Secreted by the pineal body, melatonin acts to synchronize sleep cycles, secretion of other hormones, and a multitude of other bodily processes. Its secretion is pulsatile, occurring in bursts after the onset of sleep. Taken in supplementary form in doses of 200 mcg per night, melatonin strengthens immune function by enhancing the thymus gland's production of T-cells and amplifying the effects of interleukins.

Conclusion

Pending further concrete knowledge, the alternative or complementary replacement of critically important physiologic regulators as they decline with age remains a challenge. However, the scientific and medical literature, as well as many patents filed with the U.S. Government, enable us to reasonably expect that quality of life can be maintained and restored with available nutritional supplements, particularly

DHEA, melatonin, and growth hormone secretagogues. With such means of slowing the aging process, the goal of living well past the century mark is as relevant today as our current longevity was at the turn of the last century.

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