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EDITORIAL

The New Gerontology

Previously unimagined numbers of people are growing to be very old in America. At the turn of this century 4% of the U.S. population was over age 65. Today that percentage has climbed to 13%. Life expectancy at birth in the United States has increased from 47 years in 1900 to over 76 years today and will likely reach 83 years by the year 2050.

Are we living healthier or just longer? Mounting evidence indicates a compression of morbidity in old age. The prevalence of several chronic disorders including arthritis, dementia, hypertension, stroke, and emphysema is falling. Eight-nine percent of those 65 to 74 report no disability, and even after age 85, 40% of the population is fully functional. Not only are disability rates falling, but the proportion of elders residing in nursing homes has declined from 6.3% in 1982 to the current 5.2%. Sixty-five-year-old American men are likely to spend 12 of their remaining 15 years fully independent. Today there are at least 1.4 million fewer disabled older persons in the United States than there would have been if the health status of the elderly had not improved since 1982.

In the context of this rapidly changing elderly population, a "new gerontology" is emerging that goes beyond the prior preoccupation with age-related diseases such as Alzheimer's to include a focus on senescence, the progressive nonpathological, biological and physiological changes that occur with advancing age and that influence functional status as well as the development of disease. There are significant qualitative as well as quantitative differences between age-related (senescent) and disease-related (pathological) processes, distinctions emphasized in this issue by Morrison and Hof's (p. 412) contrast of the subtle nondegenerative neurobiological modifications associated with age-associated memory loss and the degenerative lesions seen in Alzheimer's disease.

The recent acceleration of basic research in fundamental processes of senescence has been fueled by exciting findings in many areas, including several that are likely to yield insights not only into aging but also into age-related diseases, such as cancer. Promising areas include studies of telomeres, free radicals, and genes controlling cell cycling, signaling pathways, and total replicative capacity. In an interesting recent observation, Kimura *et al.* (*Science*, 15 August, p. 942) reported that a gene (*daf-2*), which regulates life-span in *Caenorhabditis elegans*, codes a protein with a striking resemblance to the human insulin receptor, suggesting a role for glucose metabolism in regulating the aging process. This is consistent with the well-documented impact of caloric restrictions on increasing life-span in rodents.

In addition to this basic research, a second major aspect of the new gerontology, also focused on senescence, recognizes that there is more to successful human aging than just the avoidance or delay of disease. It also requires maintenance or enhancement of physical and cognitive function and full engagement in life, including productive activities and interpersonal relations. Many older persons previously considered "normal" are now seen to represent "usual aging," that is, they have a constellation of age-related or lifestyle-dependent changes such as increases in systolic blood pressure, abdominal fat, blood glucose, insulin, or homocysteine that convey risk of disease or dysfunction. In addition to being risky, many aspects of "usual aging" can be avoided or reversed. Interdisciplinary studies in older persons combining physiology, epidemiology, and the social and behavioral sciences have identified lifestyle, nutritional, psychosocial, and other factors important in maintaining or improving high physical function, including strength and balance, and cognitive function, including memory. Replacement therapies with substances such as human growth hormone, insulin-like growth factor 1, DHEAS (dehydroepiandrosterone sulfate), and estrogen represent promising strategies, and are reviewed by Lamberts *et al.* (p. 419). Research programs supported by the MacArthur Foundation and the National Institute on Aging have demonstrated the substantial reversibility of loss of function with age as well as the limited impact of heredity on health and functional status in old age, as reviewed by Finch and Tanzi (p. 407). These findings have led to optimism regarding our capacity to attain successful aging, and preventive gerontology now aims not just to retard disease but to prevent functional decline. Health and functional status in late life are increasingly seen as under our own control. The stage is set for major community-based intervention studies designed to enhance the likelihood of older persons not only to avoid disease and disability but to truly age successfully.

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