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What to Expect from Gerontological Research?

While disease control is a rational goal of scientific endeavor, the wisdom of controlling natural aging can be questioned. Such a goal would be as unrealistic as the expectation of limitless development in a world with limited resources. What, then, should we expect from research on aging?

Aging, although a profound concern of mankind, still escapes definition. Some biologists claim that the asymptomatic decline experienced as aging is the integrated expression of familiar but unrecognized disease entities. If this were so, any prevention of a chronic disease could be viewed as a modification of age: a man demonstrably protected against prostatic cancer or osteoarthritis could claim to be younger than those at risk, even if their chronological ages were the same. Others object that the incidence of chronic disease is not randomly distributed over the life-span; beginning with the fourth decade it increases exponentially, suggesting the existence of a time-dependent, irreversible process predisposing to but not identical with disease. If there were such a process, common to all cells or organs, lethal conditions occurring from adulthood onward would be mere complications of a ubiquitous disorder. To identify and manipulate this disorder at will carries the potential of a true panacea that would enable us to do away with a multitude of specific, costly, but purely symptomatic approaches to treatment. It is puzzling that contemporary medicine lacks both the observational data and the conceptual tools to decide conclusively between these alternatives.

To measure biological age represents another formidable challenge to research. At present, the biological age can be assessed only by quantitating its epiphenomena. It is a statistical entity that cannot be measured like temperature or weight. Age-related lesions progress at widely different rates. A small number of them kill before a majority of others become clinically significant. Only lesions of the first group enter human experience as actual diseases, those of the second are viewed as mere symptoms of age. Some of them are sufficiently quantifiable to allow an assessment of the organism's biological age, but this always involves assumptions. What is called for—first in the experimental animal and then in the patient—is to achieve a verifiable discrepancy between the biological and the chronological age of individuals.

To the extent that medicine will be able to control the leading causes of death, slowly evolving diseases now experienced only in their subclinical stages will reach proportions that warrant medical attention. It would follow that, contrary to the prophecies of Huxley's *Brave New World*, man will never die from old age alone but always from disease. However, terminal disease of the future will be different from that we are faced with now and, presumably, more diversified.

Contemporary medicine cures or prevents damage wrought by the environment. It achieves this by neutralizing pathogens or by compensating for the lack of something the environment normally supplies. Even genetic disease is dealt with in this fashion, be it by intercepting some environmental trigger or by prosthetic means. Medicine's thrust is ecological. Man himself remains beyond its reach. But with increasing age, the causation of disease shifts away from the environment to originate more and more in the organism itself. At the same time, man's capability to counter this intrinsic pathogenesis by ecological means, which has been so effective up to now, is approaching its limits, in spite of further sophisticated (and socially inconsequential) advances. Medical care, one might say, remains in its infancy as long as it cannot forestall intrinsic pathogenesis as effectively as that originating in the environment. To overcome this limitation is the true aim of gerontological research. In initiating the revolutionary step from an environmentally oriented health care to one centered on man himself, it becomes the very foundation of future scientific medicine.—FREDERIC C. LUDWIG, *Department of Pathology, College of Medicine, University of California, Irvine 92717*