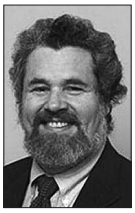
Will U.S. life expectancy rise until the end of the century?



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Yes

Increasing lifespan during the 20th century was accomplished by preventing people from dying prematurely, without affecting the fundamental processes that cause aging. Further advances in preventing the major causes of death in industrialized societies, such as heart disease and cancer, will make progressively smaller contributions to lifespan because they occur at later ages.

Preventing one late-onset disease doesn't make much of a difference in overall lifespan in the face of the general aging process that is causing many tissues to function less effectively. From this perspective, U.S. life expectancy is unlikely to make dramatic increases during the next 90 years. However, the rules of the game are changing.

A new perspective on the evolution of aging has emerged from the realization that our bodies invest a lot of resources in maintaining healthy tissues, and that it is wasteful to invest enough to keep us healthy for 200 years if most of us would be dead by 35 under Stone Age conditions. As a consequence, evolutionary forces have acted to limit many "quality control" systems, so that we are reasonably healthy during our expected lifespan in the wild, but not forever.

Dramatic advances in our understanding of these systems have been made over the past several decades. Many of these stem from genetic studies in model organisms such as roundworms, flies and mice. These organisms possess feast-and-famine strategies: When times get tough and the probability of offspring surviving is small, it makes sense to shut off reproduction and invest as much as you can in keeping yourself healthy enough to survive until times get good again.

This is why dietary restriction (severe enough to mimic tough times) has been found to induce a large number of stress resistance/repair/quality-control pathways and extend lifespan in many different species. Phenomenal advances have been made in defining the molecular pathways that regulate these responses. Given the rate of progress, it is almost inconceivable that over the next 90 years we will not be able to intervene and manipulate these pathways, slowing the aging process and producing both increased years of health span and life expectancy.

We face many challenges, and global disruptions due to climate change, limited fossil fuels, famine and war all have the potential to derail optimistic future predictions. However, if we can avoid these catastrophes, the prospects for increasing human health span/lifespan by at least 20-30 percent in the 21st century are very rosy indeed.

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No

No matter how hard we try or wish it to be so, life expectancy in the United States won't continue to rise. Here's why:

Biodemographic forces: Raising life expectancy by one year today is far more difficult to accomplish than it was a half-century ago, and it will inevitably become exponentially more difficult as time goes by.

Biological clocks: Evolution could not have given rise to aging or death programs orchestrated by genes, but we do have fixed genetic programs for growth, development and reproduction. Biological aging is an inadvertent byproduct of these fixed programs for early life developmental events. By way of example, there is no genetic program that limits how fast we can run; yet no one disputes such limits exist. Upper bounds on rising life expectancy exist for the same reason.

Biomechanical constraints: Our body parts wear out at varying rates with time and use. Our Achilles' heels are non-replicating cells that make up muscles and neurons — implying that living machines have a biological warranty period, and most of us already live beyond it.

Observed worsening health: Forecasting life expectancy based on linear extrapolation is like driving a car by looking in the rear-view mirror. If we look in the right direction, health indicators for the U.S. suggest that younger cohorts today are less healthy than their predecessors. This is especially true among minorities where recent declines in life expectancy have already been observed — a drag on life expectancy that is likely to increase.

Life expectancy does not rise unabated: There has never been an entire century in recorded history when life expectancy rose unabated — including the century in which we now live. Fluctuations in death rates are a normal and consistent part of human mortality dynamics. The fact that life expectancy failed to rise unabated even in this century suggests we're in for a rocky ride ahead.

Duration of life is fundamentally driven by our biology, not by past trends. I am optimistic that many of the dampening effects on life expectancy can be ameliorated through behavior modification, biomedical technology and the development of interventions that slow aging. However, until these miracles of the 21st century are invented and disseminated, available evidence suggests that life expectancy in the United States will soon level off and perhaps even begin declining. It most certainly will not continue unabated throughout the remainder of this century.