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Guest Editorial

Is Aging Biology Ageist?

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Abstract

The scientific questions we pursue are shaped by our cultural assumptions and biases, often in ways we are unaware. Here, we argue that modern biases against older adults (ageism) have unconsciously led aging biologists to assume that traits of older individuals are negative and those of younger individuals positive. We illustrate this bias with the example of how a medieval Chinese scholar might have approached the task of understanding aging biology. In particular, aging biologists have tended to emphasize functional declines during aging, rather than biological adaptation and population selection or composition processes; the reality is certainly that all these processes interact. Failure to make these distinctions could lead to interventions that improve superficial markers of aging while harming underlying health, particularly as the health priorities of older adults (autonomy, function, freedom from suffering, etc.) are often quite different from the goals of aging biologists (reducing disease, prolonging life). One approach to disentangling positive, negative, and neutral changes is to map trajectories of change across the life course of an individual (physiobiography). We emphasize that our goal is not to criticize our colleagues—we have been guilty too—but rather to help us all improve our science.

Keywords: Ageism, Biogerontology, Biology of aging, Epidemiology, Health

Let's conduct a thought experiment: You are a philosopher in Ming Dynasty China, a special advisor to the emperor to help him prolong his lifespan. You are an expert in both Confucian thought (hierarchy, veneration of elders, etc.) as well as Taoist religion (living in harmony with nature, techniques to achieve immortality). Through an improbable time warp, you are able to travel to the future and learn about modern scientific methods and mechanisms, and then return to your own era and courtly functions. You come back fully equipped to conduct modern science in medieval China (including, through some magical mechanism, all the laboratories and trained personnel you would need), but you retain your cultural values. In your experience, most people do not live to become elderly, and those who do are exceptional, worthy of great respect. Their accumulated knowledge and opinions hold great weight, and everyone aspires to become like them.

What biological strategies might you try to prolong the emperor's (and your) life? One approach would be to compare biomarker levels between younger and older subjects, with the hope of identifying biomarkers of aging. But unlike in modern research, you would not try to find ways to make old individuals have biological profiles resembling the young; rather, you would seek ways to make young individuals resemble the old, just as the young in your world seek to emulate the old psychosocially and culturally! Obviously, the elderly are worthy of emulation generally, and by copying their biomarker profiles, we could ensure that we are on the same trajectory as they are, toward long life. We might also succeed in imbuing ourselves with some of their wisdom along the way.

As absurd as it is, this thought experiment clearly shows how the scientific questions we ask reflect our cultural biases, even when the science appears to be objective (eg, basic mechanisms of aging). When we use terms such as "immunosenescence" rather than "immunomodulation," or even sometimes "age-related declines" rather than "age-related changes" (when the concept of decline reflects a judgment), we may be revealing our values and our and ageism (1), and allowing these biases to influence our science. For example, algorithms to calculate biological age often use biomarkers thought to change monotonically with age to calculate a score, with the assumption that lower values of biological age are preferable (2,3). Alternatively, such scores can be calibrated using younger individuals

as the "norm" (4). In addition, research on heterochronic parabiosis in mice suggests that transfusions of blood from young to old mice have some rejuvenation properties (5), but epidemiological data suggest these benefits may not translate into humans (6). If it were that easy to prolong life and health, surely evolution would have found a way to keep any key factors elevated throughout life; most likely, declines in stem cell potential controlled by such factors protect against cancer, but at the cost of declining functionality. Yet we do not put the blood of old mice into young individuals and then tout its anti-cancer properties: the questions we ask, the experiments we conduct, and the way we interpret their results all reflect our cultural assumptions.

There is now substantial research showing that, as a society, we devalue older adults and look at them as burdens to be minimized. In fact, older adults are one of the most stereotyped groups in our society (7), with focus on deficits, declines, and negative aspects of aging (8). Ageism is both widespread and frequent, with the vast majority of older Americans (84%) and Canadians (91%) reporting having experienced ageism (9). Is it any surprise then that our scientific framework supposes that the physiological states of the young are those to be emulated?

Obviously, our Chinese philosopher-sage is no more correct than we are. Both perspectives are arbitrary, and both miss the mark by letting cultural suppositions and biases color the science. The reality is that aging (by which we refer to all changes that are correlated or associated with chronological age (10)) is a composite of multiple processes. Some processes are pathological, reflecting problems in function. Some are adaptations to pathology as the internal physiology adjusts to a new reality (11), likely a result of natural selection optimizing the life course given other age-associated changes (12). Some are selection biases, reflecting the fact that those who survive to be old are not a random sample of the population. And some are simply third factors that correlate with, but are not causally related to, any of the earlier. Even among the pathological processes, some might reflect an inherent, universal biological aging process, whereas others might reflect age-related changes in risk or population-dependent processes such as development of metabolic syndrome and diabetes.

Our cultural assumptions around aging have, in many cases, blinded us to these distinctions. Although we are hardly the first to remark on them, we believe that the role of ageism in structuring biological questions has so far passed largely unnoticed, and that by pointing it out we may be able to both improve our reasoning to understand aging biology, and to combat the poor treatment of older adults that results from these biases. For example, when older adults are asked what matters to them, their priorities (functionality, staying at home, absence of suffering, dying with dignity, proximity to loved ones) are often poorly aligned with those of aging biologists (curing diseases, prolonging life at all costs, etc.) (13,14).

One solution to this would be to use "physiobiography" to track individual physiological/biological trajectories over the life course, parallel to the recently proposed idea of immunobiography (15). In this way, we could identify trajectories of individuals with successful aging and seek to emulate these trajectories. Much as proposed by Freund (10) for phenotypic models of mouse aging, this approach minimizes the questions around definitions and judgments of aging, while at the same time explicitly forcing us to define what we consider "successful aging." Along these lines, we also need to be careful to ensure that any "young" comparison groups are young adults rather than juveniles, as can often be the case in mouse studies; use of juveniles risks confounding aging and development. One approach to this would be develop more continuous methods in laboratory models; this has statistical benefits in addition to allowing nuance beyond the young-old dichotomy.

Although a physiobiography approach is promising, caution is still warranted: changing one or two elements in a trajectory could actually be detrimental if we do not know how to distinguish aspects of the trajectory that are causing problems from those that are adapting to them. Finally, it is always worth remembering the substantial body of evidence showing how important psychosocial, cultural, and lifestyle factors are in determining the aging process (16); the biology occurs in and is shaped by a larger context, from which it cannot be divorced.

Our goal here is not to politicize our field or make it politically correct. We cannot claim ourselves to be completely free from the ageism that is baked into modern society, and we make no judgments. Rather, we argue strongly that becoming conscious of our cultural assumptions will not only help us to treat older adults better; it is also essential both for conducting good science and for directing this science toward the questions that can actually have the most benefit for our demographically changing society.

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Conflicts of Interest

A.A.C. is founder and Chief Scientific Officer at Oken.

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