

Recent Developments in the Ethics, Science, and Politics of Life extension

Nick Bostrom, University of Oxford

Document reviewed

The Fountain of Youth: Cultural Scientific and Ethical Perspectives on a Biomedical Goal. Eds. Stephen G. Post and Robert H. Binstock (Oxford University Press, 2004). 461 pages.

Abstract

Blackballing the reaper is an old pursuit, and considerable progress has been made. For the past 150 years, best-performance life expectancy (i.e. life expectancy in the country where it is highest) has increased at a very steady rate of 3 months per year¹. Life expectancy for the ancient Romans was circa 23 years; today the average life expectancy in the world is 64 years. Will this trend continue? What are the consequences if it does? And what ethical and political challenges does the prospect of life extension create for us today? This article comments on some views on the ethics, science, and politics of life extension from a recent edited volume, *The Fountain of Youth*.

The disciplining of biogerontology

Robert Binstock's opening chapter sketches a historical background to the rise of gerontology as a scientific discipline and describes its struggles to disassociate itself from the charlatanism with which anti-aging medicine has often been associated. Binstock quotes Gerald Gruman who in 1966 wrote of the idea of prolongevity and its proponents that they have tended to be

relegated to a limbo reserved for impractical projects or eccentric whims not quite worthy of serious scientific or philosophic consideration. One reason for this is that there is, in philosophy, science, and religion, a long tradition of apologism, the belief that the prolongation of life is neither possible nor desirable ... Another reason is the fact that there are few subjects which have been more misleading to the uncritical and more profitable to the unscrupulous; the exploitation of this topic by the sensational press and my medical quacks and charlatans is well-known. (Post & Binstock, 2004, p. 11)²

Since Gruman wrote those words, the search for prolongevity has become a more reputable activity. The creation of the National Institute of Aging in 1974 did much to boost the scientific credentials of the discipline,

and biogerontology is by now generally accepted by the wider scientific community as a legitimate area of research and by the government as an appropriate field into which to plow sizable amounts of public funding.

The legacy of the field's earlier rogue status, however, has continued to shape both public perceptions of the discipline and internal developments within it. Anxious not to allow their hard-earned scientific respectability to be undermined by the exploits of quacks or the sensationalist press, mainstream biogerontologists engage in various kinds of 'boundary work' which is meant to keep legitimate science in, claims made by peddlers of allegedly age-retarding supplements out, and to make sure that the public is aware of the difference.

As one example of such boundary work Binstock cites a position paper on aging written by three scientists, Jay Olshansky, Leonard Hayflick, and Bruce Carnes, and co-signed by an international roster of 51 researchers in the field of aging. Versions of this statement were published in *Science*, the *AARP Bulletin*, *Scientific American*, the biological science journal of the Biogerontological Society of America, and it was later reprinted in translation in five other languages. This consensus statement concludes:

Most biogerontologists believe that our rapidly expanding scientific knowledge holds the promise that means may eventually be discovered to slow the rate of aging. If successful, these interventions are likely to postpone age-related diseases and disorders and extend the period of healthy life.... Our concern is that when proponents of antiaging medicine claim that the fountain of youth has already been discovered, it negatively affects the credibility of serious scientific research efforts on aging. Because aging is the greatest risk factor for the leading causes of death and other age-related pathologies, more attention must be paid to the study of these universally underlying processes. Successful efforts to slow the rate of aging would certainly have dramatic health benefits for the population, by far exceeding the anticipated changes in health and length of life that would result from the complete elimination of heart disease, cancer, stroke, and other age-associated diseases and disorders (Olshansky *et al.*, 2002, p. 297).

The same trio that authored this statement is also handing out an annual 'Silver Fleece Award' in 'a lighthearted attempt to attempt to make the public aware of the anti-aging quackery that has become so widespread here and

abroad' (p. 24). (Winners receive a bottle of salad oil labeled 'Snake Oil' – typically presented in absentia.)

Another strategy employed in this disciplinary boundary work, according to Binstock, has been to emphasize compression of morbidity or 'adding life to years' as the therapeutic goal and potential practical payoff of aging research, rather than life extension or 'adding years to life'. Reflecting this priority, a vast proportion of the funding doled out by the National Institute of Aging's is given to research on Alzheimer's disease. According to one estimate, only about 0.02% of the money spent by the National Institutes of Health (of which the NIA is part) is spent on fundamental aging research (see Sage Crossroads, 2004).

Some biogerontologists have come to believe that this heavy focus on compression of morbidity has drawbacks. One reason for this is that the goal of compressing morbidity might be unrealistic. Since healthy people tend to be less likely to die than the sick, a likely side effect of adding life to years is that years will also be added to life. Except when treating diseases that incapacitate long before they kill (neurodegenerative conditions being the prime example), it is likely that efforts to *compress* morbidity will mainly end up *postponing* it (de Grey, 2003). Admittedly, by successive postponements of the onset of morbidity, the ratio of healthspan to 'frailspan' would improve. However, if the aim is to increase this ratio of healthspan to frailspan, the question must be asked whether a strong focus on compressing morbidity is really the best means to this end.

It is doubtful that further dramatic increases in healthspan could be achieved by developing better treatments for the specific diseases that affect the elderly. If the underlying increase in vulnerability to disease that naturally occurs with increasing age is not addressed, then curing one particular disease in an old person is likely to yield only a modest increase in healthy expectancy. For people in developed countries to achieve *large* gains in health expectancy, what is needed is a stronger focus on the underlying biological processes of senescence. As biogerontologist Aubrey de Grey and others have emphasized, only by slowing or reversing some of these processes will further dramatic gains in healthy lifespan be possible (de Grey *et al.*, 2002). If healthspan increases and frailspan stays constant, then the morbidity that commonly precedes death would comprise a smaller fraction of the total lifespan. This would result in a relative if not an absolute reduction of morbidity. Such a relative reduction of morbidity due to extended healthspan would mean that the fraction of the population suffering from illness and disability at any given time would diminish.

Such a shift of focus would require the biogerontology community to more openly embrace and promote the goal of developing therapies that could significantly extend the human healthspan. Research funding priorities would need to be adjusted to strongly encourage the study of the

biochemistry of aging and the exploration of possibilities for therapeutic intervention in the aging process. Although the payoff from this type of research in terms of medical products might be further into the future than is the case for research into individual diseases, the eventual health benefits that could come from such research are enormous. Because a great deal of basic research needs to be done before product development could begin at a large scale, economic benefits are mostly beyond the time horizon for pharmaceutical companies, and there is consequently an urgent imperative for public funding. If the estimate mentioned above is correct and currently only about 0.02% of NIH's budget is devoted to fundamental aging research, one is led to the suspicion that a socially optimal level of funding for biogerontology might easily be as much as 100 times its present value, or more.

If research into senescence has such huge potential, why has there not already been a greater shift in this direction? Another chapter in the book, by Richard A. Miller, lists a number of possible reasons. We have already noted the prevailing tendency to emphasize morbidity compression rather than life extension; whence, perhaps, the prioritization of e.g. on neurodegenerative disease rather than basic aging research. Another factor, according to Miller, is that

Senators' and voters' parents died of specific diseases. Cancer, kidney disease, acquired immune deficiency, lung diseases, and Alzheimer's disease, all have enviable lobbies raising significant amounts of private funds for research, and, more importantly, convincing legislators to devote public funds to disease-specific research programs (p. 241).

Basic aging research, by contrast, does not have the same appeal to any particular disease group or other powerful advocacy organization. Lacking lobbyist support, biogerontology suffers in the competition for resources and has to make do with scraps that fall off the table where the big funding is dished out.

Miller also points out that aging experiments in mammals usually take more than four years to finish, whereas young scientists need to write a lot of papers to advance in their careers. 'No responsible mentor will advise a smart and ambitious protégé to go into biogerontology research (except possibly in malleable but questionably relevant model organisms that have the grace to die in a few weeks)' (p. 241). In a similar vein, many aging experiments in mammals do not require fancy equipment or cutting-edge methodology, again making the field of aging less attractive to those who wish to hone their laboratory skills and display scientific prowess.

A further impediment is that the present lack of good methods to measure aging. To test whether a potential intervention is successful in retarding senescence, the current standard protocol is to observe how long it takes for the animals in the experimental and the control group to die. In long-lived organisms, this entails waiting for

many years to get even preliminary data on some experimental intervention. Developing panel of biomarkers for aging is clearly an important priority at this point.

The ethics of life extension

Richard Miller mentions yet another obstacle preventing the development of effective anti-aging interventions: 'gerontologophobia'. There is, he writes,

an irrational public predisposition to regard research on specific late-life diseases as marvelous but to regard research on aging, and thus on all late-life diseases together, as a public menace bound to produce a world filled with nonproductive, chronically disabled, unhappy senior citizens consuming more resources than they produce. ... Pointing out that such an argument would inveigh, with equally fallacious force, against research on heart attacks, diabetes, and cancer (whose goals, like those of gerontology, are to allow people to live longer and healthier lives) does little good in practice to dispel this fixed belief (p. 243).

This common attitude towards aging has been compared to the Stockholm syndrome, in which hostages develop an emotional attachment to their captors. The victim comes to see the captor as a 'good guy,' a savior. Freed hostages are even known to have participated in the legal defense of their former captors and to have raised money for a legal defense fund. Perhaps in an analogous way, apologetics for human senescence might be viewed as a psychological defense mechanism that many people deploy as a way of coping with their own inescapable 'capture' by the aging process. But just as the emotional bonding observed in the Stockholm syndrome can become counterproductive when it leads hostages to actively assist their captors in thwarting rescue efforts by the police, so too our adaptive acceptance of aging may become a problem when it prevents us from implementing the most promising research programs for improving healthy life expectancy.

The ethics of life extension is covered in several chapters of the book. Leon Kass, a prominent bioconservative ethicist, is an outspoken opponent of the goals of anti-aging medicine. Longer lives, Kass believes, would reduce our incentives to make the most of the time we have. He also maintains that

simply to covet a prolonged life span for ourselves is both a sign and a cause of our failure to open ourselves to procreation and to any higher purpose... [The] desire to prolong youthfulness is not only a childish desire to eat one's life and keep it; it is also an expression of a childish and narcissistic wish incompatible with devotion to posterity (p. 317).

Kass is not the only commentator who has criticized prolongevity on ethical grounds. Another is Audrey Chapman, also in the present volume. Chapman worries about the justice implications of investing in the quest for

longer lifespan: isn't it wrong to spend money on studying aging in a world where many people lack access to clean drinking water and basic health care?

Opponents of prolongevity, however, fail to offer a convincing explanation of why it would be ethically acceptable for society to be spending vast amounts on researching and curing particular diseases in an effort to extend healthy life for people in rich countries and yet unacceptable to conduct research into the biology of aging in order to develop more effective interventions to achieve the same aim.

Another problem for the justice objection to life extension research is that one could argue in reply that if we want to do more to help the poor, we should surely sacrifice some less essential form of consumption rather than forego potentially lifesaving medical or biogerontological advances. It is unclear why aging research should be singled out for blame or special concern in this regard. Many factors contribute to global inequality, and spending on gerontological research is such a minute fraction of the financial outlays of wealthy nations that it seem a bizarre place to look for savings to transfer to the poor.

Perhaps the critics' worry is not so much the money we spend on aging research but rather the consequences if this research should succeed in extending healthspan. Some commentators have worried that longer healthy lifespans for people in the rich world would lead to increased pressure on the environment or, alternatively, that it would be intrinsically unfair for some people to live much longer than others. It is worth noting that this objection presupposes that biogerontology is a more effective means to extending healthy life span than are other kinds of medical research. If it weren't more effective, then the objectors ought to favor focusing health care funding on biogerontology on grounds that this would be less likely to produce what they maintain is a negative outcome, i.e. longer healthspan for people in developed countries. In other words, those who believe that longer healthspan would be on balance bad should, in order to be consistent, prefer that money earmarked for medical research go to those research projects that are *least* likely to succeed in lengthening healthspan. This would be an exceedingly odd position to hold. Might one suspect a 'Stockholm syndrome' of playing a role here?

It is not only in terms of its therapeutic goal – in seeking the prolongation of healthy lifespan – that biogerontology is continuous with other forms of medical research. Biogerontology is also increasingly overlapping with other parts of medicine in its subject matter. As several of the book chapters on the science of aging make clear, the more we understand about the biochemical processes involved in senescence the more we find that they look like disease processes. The accumulation of lysosomal aggregates and amyloid plaques, extracellular protein-protein cross-linking, nuclear and mitochondrial mutations, cell atrophy,

cell senescence, and cell loss without replacement: these processes may all be implicated in both pathology and senescence (see e.g. pp. 249-267). At the level of genetics and biochemistry, there simply does not seem to be any meaningful distinction between 'processes predisposing to or constituting disease' and 'normal aging'.

It is now also generally accepted that aging is not an evolutionary adaptation. Aging, rather, is what happens when various bodily systems evolved to maintain health gradually accumulate defects and begin to dysfunction. In the Pleistocene, when life expectancy is estimated to have been a mere 20 years, too few of our ancestors survived to ripe old age for evolution to favor investment in stronger anti-aging defenses than those we now possess and are forced to rely upon, notwithstanding their evident inadequacy in the modern era where many causes of premature death have been removed.³ (The tortoise, by contrast, whose ancestors were less accident-prone thanks to their protective shells, enjoys anti-aging defenses robust enough to give it a lifespan of upwards of 150 years. It is humbling to reflect that somewhere on the Galapagos Islands a giant tortoise might still be around who watched the landing of Charles Darwin.)

Bioethicist Arthur Caplan, in another chapter, presents a more positive ethical assessment of the prospect of life extension, concluding that aging is 'in no way an intrinsic part of human nature' and that 'there is no reason why it is intrinsically wrong to try to reverse or cure aging' (p. 283). Eric Juengst, too, while pointing to some further ethical questions that he thinks have not yet been answered, holds the door open for prolongevity: 'As long as anti-aging interventions serve to forestall the morbidities associated with the aging process, they have a legitimate place in the armamentarium of preventive medicine' (p. 336).

Christine Overall, a Canadian philosopher who has examined the ethics of life extension in detail in a recent monograph, has an even clearer view of the value of prolongevity:

[O]ther things being equal, a longer life is a better one, provided that one is in a minimally good state of health. The case for longer life ... is founded on a genuine appreciation of human potential, of what people want in their lives and are capable of doing and experiencing when given more opportunities. An increased lifespan gives human beings the chance for activities and experiences that they would not otherwise have enjoyed. Collectively, extending average life expectancy provides for the society in which it occurs the value of increased experience, know-how, labor, loving relationships, and so on – that is, whatever healthy old(er) people can contribute. (p. 287)⁴

Overall's chapter examines from a feminist perspective what changes in social norms and moral attitudes are called for in response to increasing human longevity. She draws

a parallel with other systematic forms of oppression, such as sexism, racism, classism, ableism, and heterosexuality, and highlights how *ageism* needs to be opposed along with these other noxious '-isms':

Contrary to ageist stereotypes about aging people, the potential to adapt and change is a fundamental characteristic of all human beings at all ages. Hence, as human lives get longer, it will be essential to be critical of categories such as the *elderly*, *the aging*, and *senior citizens*. We would have to give up, once and for all, the unthinking assumption that adulthood is the apex of life, for which childhood is the preparation and from which old age is merely the decline and downward deterioration. (p. 297)⁵

As the practical possibility of doing something about aging draws closer, one may hope that ambivalence and negativity that have sometimes characterized ethical assessments of prolongevity will give way to a more steady focus on what must surely be the central fact in this discussion: that people's lives and health are at stake, and that any delay in the development of rejuvenation therapies means that thousands of people, who could have been saved, will get cancer, Alzheimer's disease, heart disease, arteriosclerosis, and other age-related ailments, and will die as a result. The humanitarian imperative to avoid this outcome needs to be kept firmly in mind at all times when we consider the various problems and challenges that may arise as we succeed in further extending healthy lifespan.⁶ For any possible problem that might arise, one question that we must not fail to ask ourselves is: 'Is this problem *so* bad that it is worth sacrificing up to 100,000 lives per day to avoid having to solve it.'⁷ If the answer is no – and it is hard to imagine how it could be otherwise – then the problem is not a sufficient reason to oppose the development of effective anti-aging therapies.

Life extension, politics, and social priorities

The need to rethink the ageist stereotypes that Overall discusses in her chapter becomes more obvious if we take into account that older people in the future may be beneficiaries of rejuvenation therapies that reduce or eliminate the correlation that currently exists between age and health status or economic productivity. If such a situation, it might not make sense to base social entitlements such as education subsidies, Medicare, employment rights, and retirement status on chronological age. Instead, more individualized criteria would have to be developed that take into account each person's needs and actual functional capacities.

In Robert Binstock's second chapter in the book, he examines the political implications of population aging. He notes that negative opinions of the value of prolongevity are often based on ominous forecasts of the impact on society of having a growing number of older persons. Some have feared the emergence of a 'gerontocracy,' in which an

expanding senior demographic would vote through ever-increasing and economically unsustainable retirement benefits and other policies advantaging the old. In 1987, bioconservative ethicist Daniel Callahan described the growing population of older Americans as a 'social threat' and 'a demographic, economic, and medical avalanche' (Callahan, 1987, p. 23) and characterized programs benefiting the aged as 'one of the great fiscal black holes' (Callahan, p.216). A year later, the term 'greedy geezers' was coined as an epithet for older people (see p. 376 and references therein.). Concerns about 'The Tyranny of America's Old' and the 'graying of the budget' continue to surface periodically in the press.

Are those appropriate ways of viewing older citizens and their interests? Perhaps, as Christine Overall argued, such attitudes are no less odious than the habit – only recently extinguished – of referring to people with disabilities as 'invalids' and as 'burdens on society'. But whatever one might think about that matter, it is clearly an interesting empirical question whether the predictions of an emerging gerontocracy will turn out to be correct.

Binstock argues that the evidence does not support the senior power model that underlies these predictions. While older people constitute a numerically large and growing component of the electorate, and while voter-turnout in this group is high, Binstock claims that their voting behavior is not cohesive:

Older people are as diverse in their voting decisions as any other age group; their votes divide along the same partisan, economic, social, gender, ethnic, and other lines as those of the electorate at large. (p. 369)

Old age interest groups such as the AARP, Binstock concedes, do have some limited power; yet 'they have shown little capacity to influence the votes of older people and have had virtually no impact on major old-age policy decisions' (p. 372).

One should not assume that 'the old' will necessarily have common set of political interests. Seniors who are wealthy might have different interests from those who are poor. Different age groups among the seniors – 'the young old', the 'old old', and 'the oldest old' – might likewise have

different stakes in social policies. Policy options could be deliberately crafted in ways that split the block of elderly voters. Moreover, many elderly citizens might not vote in their self-interest but rather in support of policies that benefit e.g. their children or grandchildren. In sum, there are according to Binstock too many imponderables to make any definite predictions about the political consequences of effective anti-aging interventions.

The Fountain of Youth: good value for money

Overall, the *Fountain of Youth* offers a well-produced and balanced introduction to the discourses surrounding the prospect of longer life. In addition to chapters on science, ethics, and social consequences, a few of which were reviewed here, the book also contains several essays that examine the issue from religious perspectives or that explore how the themes of immortality and prolongevity have been depicted in literature. There is also a useful 44-page of annotated bibliography, compiled by Roselle Ponsaran and Carol Donley.

One perspective that is notably missing from the book is that of health economics. It might be unfair to fault the editors for this omission – any one book on a topic as multifaceted as life extension will inevitably leave something out. Nevertheless, a chapter or two on the economical implications of extended healthspan would have been extremely useful, especially considering how frequently economic issues are brought up, by *non-economists*, in discussions of social and ethical implications of life extension.

Recent studies in health economists indicate that improvements in the health status of the population over the 20th century have made as large a contribution to raising the standards of living as all other forms of consumption growth combined (Murphy & Topel, 2003; Nordhaus, 2003). This remarkable finding underscores the importance of the subject matter of the book. It also suggests potentially enormous returns, in terms of human welfare, to investment in biogerontological research if it could lead to a further significant extension of the human healthspan.

References

- Bostrom, N. (2005) The Fable of the Dragon-Tyrant. In: *Journal of Medical Ethics*, 31(5), pp. 273–277.
- Callahan, D. (1987) *Setting Limits: Medical goals in an aging society*. New York: Simon and Schuster.
- de Grey, A. (2003) The foreseeability of real anti-aging medicine: Focusing the debate. In: *Exp. Gerontology*, 38(9), pp. 927–934.
- de Grey, A., Ames, B., et al (2002) Time to talk SENS: Critiquing the immutability of human aging. In: *Annals NY Acad Sci*, 959, pp. 452–462.
- Murphy, K. & Topel, R. (2003) The economic value of medical research. In: K. M. Murphy & R. H. Topel (eds) *Measuring the Gains from Medical Research: An economic approach*. Chicago, University of Chicago Press.
- Nordhaus, W. (2003) The health of nations: The contribution of improved health to living standards. In: K. M. Murphy & R. H. Topel (eds) *Measuring the Gains from Medical Research: An economic approach*. Chicago, University of Chicago Press.
- Oeppen, J. & Vaupel, J. (2002) Broken limits to life expectancy. In: *Science*, 296, pp. 1029–1031.

Olshansky, J., Hayflick, L., *et al.* (2002) Position statement on human aging. In: *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 57, pp. B292–B297.

Overall, C. (2003) *Aging, Death, and Human Longevity: A philosophical inquiry*. Berkeley: University of California Press.

Post, S. & Binstock, R. (eds) (2004) *The Fountain of Youth*. Oxford: Oxford University Press.

Sage Crossroads (2004) *Does the Public's Interest in the Science of Aging Affect how the Science is Done?* Live debate, AAAS, Abelson Conference Room, 1200 New York Avenue, Washington, DC. Transcript online at: <http://www.sagecrossroads.org/Portals/0/transcript12.pdf>.

Salmon, P. (1985) *Living in time: A new look at personal development*. London: J.M. Dent.

Notes

¹ Oeppen and Vaupel, 2002.

² All page references are to this volume unless otherwise noted.

³ See e.g. chapter 6, written by Jay Olshansky and Bruce Carnes.

⁴ See Overall (2003) for an elaboration of her arguments for this position.

⁵ Overall is here also drawing from and referring to earlier work by Phillida Salmon (Salmon, 1985).

⁶ For an argument along these lines, see Bostrom (2005).

⁷ One hundred thousand is the approximate number of deaths per day due to ageing in the world.

Correspondence:

Dr Nick Bostrom,
Harris Manchester College, Mansfield Road,
Oxford OX1 3TD.
Email nick.bostrom@philosophy.ox.ac.uk.