

## Frequently Asked Questions on Longevity and Rejuvenation

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**Will this make us more susceptible to parasites because we will no longer be able to adapt properly genetically due to the few deaths and births?**

No, that will not be the case.

Humans have not been exposed to natural selection by parasites to any decisive extent since the early 20th century. The repression of diseases in infants, children and mothers through sanitation, antibiotics and vaccination has massively reshaped the process of natural selection in humans. In this respect, even prolonging our lives after our early reproductive phase will no longer represent a decisive upheaval.

People before the 20th century - and since then people in developing countries, although fortunately to an increasingly lesser extent - have been much more susceptible to parasites than people in industrialised nations today, and this despite having lived much shorter lives (partly because of parasite infections). We have been plagued by parasites for hundreds of thousands of years. We have defeated them in the developed world not through evolution - evolution has not, in fact, rid us of a single parasite - but through technology: hygiene and medicines. This is how we will make further progress in the future.<sup>91</sup>

**Won't we then also have immortal dictators?**

The worldwide proportion of dictatorships has already been steadily decreasing for several decades and the proportion of democracies has been steadily increasing<sup>88</sup> - and that without a shortening of the lifespan. So this is already a declining problem.

To make the *raison d'être* of medicine dependent on the extent to which it could also benefit people whom we do not wish to live long seems rather absurd if one takes examples from our history: Stalin, Hitler and other rulers who committed crimes against humanity might not have had the

opportunity in the first place if Pasteur had not founded medicine against infectious diseases and thus reduced infant mortality, because they would have died beforehand. Nevertheless, hardly anyone would like it better if this medicine had never been developed (assuming you know what that would mean, namely that half of all children born would still die in the first year of life from tuberculosis, diphtheria and so on).

Worldwide, there are overwhelmingly more "normal" people than tyrants and dictators. If aging were left untreated, this would leave the lives of the latter group as miserable as they currently are. Still, it would also do the same to the lives of innocent and "normal" people, who are a clear majority here and include those living under tyrants.

This scenario does not represent a desirable fate even for people who would directly benefit from the death of their oppressors. And for everyone else, it's even worse: if you lived in a free, democratic country, would you have no problem dying of a medically preventable cause just to ensure the death of a handful of tyrants who pose no direct threat to you? We would highly doubt it.

Besides, even if the tyrants and dictators are dead, this in no way guarantees that the tyranny or dictatorship will end. Since aging kills extremely slowly, tyrants today have all the time in the world to leave an heir or appoint a successor. Long story short: aging may kill the tyrant, but not the tyranny, and avoiding the fight against aging would pointlessly perpetuate the untold suffering that aging is currently causing worldwide.

Third, given the high costs and low benefits - not to mention the high likelihood of failure and the immeasurable suffering it causes - this "strategy" to eliminate tyrants is even less justifiable when one considers the alternatives: If the goal is to end a dictator's oppression of his people, it is more effective to orchestrate an attack to arrest or kill the dictator than to wait until aging eventually kills him - especially when one again considers how slow the aging process is.

### **Won't only the rich and powerful be able to afford it?**

Of all the possible concerns and challenges of human life extension, this is probably one of the most disturbing, seeing the present inequalities in access to health care.<sup>92</sup> Would then the extension of life only be made accessible for the rich and powerful? Would such preferential access for select groups be justifiable or inevitable? Would not such a fundamental disparity in the ability to survive threaten the very fabric of social coherence when society is filled with constant resentment and struggle? It has been asserted that the inability to provide goods to all people should not prevent providing it to some people.<sup>93</sup> Yet, such assertions may offer little consolation to people doomed to an early death by their social status. The inequality of access to medical means and technologies is already happening and is not necessarily reserved for future technologies. This problem needs to be recognised, and a wide and equitable sharing of medical technologies, both the present and emerging, needs to become a primary social objective.

However, in the case of effective rejuvenation medicine, restriction of access is unlikely for a number of reasons.

Once people recognise the possibility of receiving medicine that protects them from age-related disease and death, they will vote to get it and therefore vote for the party that advocates making them available to everyone. Most countries in the world are democracies and democratic leaders usually want to get re-elected.

More importantly, it would most likely be economic suicide for any country, even one as tax-shy as the US, not to make the therapies available to all citizens. Even if the world stayed as it is now, many countries would be in very bad shape in the future, with debt-to-GDP ratios already too high and rising in much of the industrialised world - and the world will not stay as it is now. You guessed it - we are talking about aging.

Demographically, the world is aging quite rapidly, especially but not only in high-income countries and China - and "demographic aging" means biological aging in a context where chronological aging means biological aging. The inevitable result is that both sides of finance will be increasingly negatively affected by aging. On the one hand, an increasing number and proportion of the biologically old population means an increasing number of people who will require a high level of medical care, mainly because of Alzheimer's disease and other dementias of old age. For the situation in the US, which is in better demographic shape than the EU, Japan and China thanks to higher immigration rates and largely immigrant-driven fertility, see these two charts on Medicare,<sup>94</sup> the US public and federal health insurance for citizens over 65:

Over the same period, demographic aging means ever-increasing costs for public pensions, albeit less extreme, since while a more significant number of old people are eligible for pensions, the cost of a single person's pension is the same at 65, 85 or 100, while medical budget consumption continues to rise with age over the same period.

And on the income side, an ever-increasing proportion of the population that is biologically aging means, of course, that fewer and fewer workers can generate the wealth and tax revenues to cope with these rising costs and the other costs of government. This can be seen in the "old-age dependency ratio", which has been declining until recently after the baby boomer demographic boom in the West faded away, and China brought its population under control through its aggressive state policies (children, like the over-65s, do not contribute to the country's wealth themselves but must be provided for through working-age adults), but is now rising again globally and will increasingly do so in the near future.<sup>95, 96, 97, 98, 99</sup>

So, if we can prevent people from going down the path of age-related illness and disability, we are talking about a gigantic net gain. A country that does not take advantage of this opportunity will probably not be able to generate enough wealth in the future to finance its expenditure and be considered a good borrower for other countries, and sooner or later go bankrupt.

Accordingly, it is much more likely that rejuvenation therapies will be available to all inhabitants of a country, regardless of their ability to pay, than that it will be withheld from all but a certain group. The relevant precedent is not today's cutting-edge medicine because it is still not very effective and does not keep people healthy for a relevant period of time. The only real precedent is basic

education, a national investment in the future, just as preventive geriatrics will be. And what is it? Free of charge.

So, living longer would not be a luxury good but, as Bill Gates would say, a global public good.

### **What will happen to pensions? Won't we then have to work all our lives?**

Is living much longer in good health desirable if you have to work all your life to do so? There are two main counterarguments here.

With the victory over aging, the justification for old-age pensions would undoubtedly disappear. This has been the case since Chancellor von Bismarck's "Law Concerning Old-Age and Invalidity Insurance" of 1889, namely that pensions are a measure against the decreasing ability to work due to age-related impairments - both to increase productivity and for social reasons.

Today, people work beyond the traditional retirement age due to longer life expectancy and better health. Conversely, we know that many of the current old population who retire at the traditional time are very unhappy about it. On average, it seems to affect their physical and mental health and shorten their life expectancy. This is the conclusion of some long-term studies.<sup>100, 101, 102</sup>

Forgoing retirement could be made a condition of eligibility for rejuvenation therapies because we can be sure that most people, if given a choice, will choose to avoid the many diseases and infirmities of aging and live longer to see their grandchildren graduate as well as have children of their own - and in return will continue to work to fund their longer, healthier lives.

Even without a traditional state-funded pension, the combination of the greatly extended overall life expectancy with the "miracle" of compound interest ensures that everyone - whether a doctor, lawyer or fast-food burger flipper - accumulates enough savings over time to periodically take a "mini-retirement", refresh themselves and rethink their life priorities.

People have to work hard until their bodies give out and they are forced to retire. They do not have the luxury of returning to educational phases - due to existing pledges, children and the looming threat that their health and income could be stolen by aging at any time. People freed by rejuvenation therapies from what is by far the biggest killer of the modern world will instead have the time to put themselves on a solid financial footing and then change careers regularly without a looming deadline hanging over their heads.

People would thus be free to:

(a) pursue a career of their choosing in indefinite continued health with the skills and knowledge of a lifetime of experience instead of being robbed of all these valuable things by biological aging;

(b) to have enough strength in their breaks from work to ski in winter and climb mountains in summer;

(c) to use the security of paid-off houses and savings to pursue a new education and then a new career because one has finally discovered one's true vocation or most probably

(d) to move from one of the above options to the next, indefinitely, living a life of leisure or as a dedicated citizen and worker, taking the path that fulfils one and keeps one a productive and contributing member of society for decades - and centuries.

That is the first answer to the above question. The second and more important answer is that the alternative - to condemn more than 100,000 people every day to perish from the effects of biological aging through our inaction is frankly morally reprehensible and personally horrific, making even a future of indeterminate low-wage work a mere red herring in the face of this.

Complementing these aspects, it should be noted that automation is gaining momentum, especially in low-skilled occupations. This Oxford study<sup>103</sup> concludes, for example, that 47% of all jobs in the UK are at risk of being automated within the next two decades. In other countries like Germany, the situation is similar.<sup>104</sup> So it is already becoming apparent that we will work significantly less in the future. One idea to ensure financial security for the population under these circumstances (and otherwise) is the introduction of a universal basic income. Models for financing this model exist, for example, taxing financial transactions, capital and property values, CO2 or even robots, but these fall outside the focus of this article.<sup>105</sup>

### **Won't then live in constant fear of accidents and avoid all risks? Will we not have to do without many things?**

It may well be that in an ageless society, we will act more mindfully in many areas of life and take better care of our environment so that we can still inhabit a world worth living in in the distant future. In the medium term, this development could lead to politicians passing laws that prescribe more responsible behaviour towards our environment or punish irresponsible behaviour more severely. Many people do not fear the consequences of their climate-damaging behaviour because they think they will not live to see them anyway. That would change with the victory over aging.

However, it is very unlikely that we will end up in a society where we isolate ourselves from all possible risks every day out of fear or where everything that could be dangerous in any way is forbidden.

Firstly, once comprehensive damage repair therapies are available that can fully regenerate the body, people might even have no problem living a much unhealthier lifestyle than in an aging society, as they would no longer have so much to think about in terms of their health. The fallacy that we have to give up all potentially unhealthy things or activities for healthy life extension even has its name - "crème brûlée error".<sup>106</sup> If machines are maintained and repaired thoroughly enough, it doesn't matter if they wear out more in between - the repair just needs to be increased. So people could often eat an unhealthy diet after defeating aging; they would just have to use the therapies earlier and more often than others. Secondly, for activities that involve a risk to the physical integrity of the person doing them, there are always two options: a) not to do the activity

and b) to make it less risky through technology. We see the latter in the current development of autonomous vehicles, among other things. So agelessness will rather lead to such developments happening faster, not to nobody leaving the house anymore just to avoid an accident.

### **Would not extending longevity stop progress and make individuals and societies stagnant?**

Rather to the contrary, the learning potential will be increased by longer life spans, and such a prolonged “cultural adaptation” may be sufficient and necessary for the survival of the society. Moreover, rationally controlled development and care for the survival of the weak may be more advantageous for progress than blind and cruel Darwinian selection.

### **Would extending longevity lead to extending boredom?**

Arguably, no, as extended life also implies extended ability to learn and change. The sense of boredom is independent of the period, and often comes and goes periodically.

Once you think about it seriously - and not just from your gut - you will soon realise that there is simply too much to do, too many different things to think, feel and achieve, for boredom to ever play a bigger role in your life than it does today.

If one also considers future possibilities, it quickly becomes clear that the feared emptiness of life is not to be expected even in the distant future: as far as the human body alone is concerned, there is still an incredible amount to explore, not to mention our own and other planets, the solar system and alien planetary systems, our galaxy or even the universe. In principle, there are no limits to artistic works, whether literature, music, painting or any other form. The virtual reality already mentioned is constantly improving and is already being used in education, research, medicine, and therapy in various ways. This, combined with realistic-looking simulations of past ages and the colonization of other planets and parts of the universe, can further enrich our lives. One day we may be able to transfer human memories to a storage medium by means of brain-computer interfaces and then selectively delete or even change them from our own brains, because even though research into this is still at a very early stage - scientists have already managed to do just that in rat and mouse brains.<sup>107,108</sup> In short, there will ultimately be an extension and a significant expansion of human life.

Should boredom occur - for whatever reason - everyone must ask themselves which option they prefer: dying of Alzheimer's at 80 or being bored at 150? Regardless of the answer, however, no one has the right to make this choice for other people, and thus no one has the right to deny other people rejuvenation therapies.

### **When we know that our time is no longer limited - do we still have the motivation to do anything?**

A drastically extended life where you have potentially unlimited time for everything: Doesn't that lead to people losing their motivation to do anything sooner or later, since they can always



postpone everything into the future, after all? Without the pressure of our mortality, wouldn't we all just procrastinate and do one day after another?

The counter-question to this is similar to the one in the last answer: Is the only reason why people today do something, make an effort or go out of their way for something, that their lives are time-limited as things stand today? Or do they not perhaps act out of interest, passion, self-evidence, duty, necessity or generosity? Did you enter into a relationship or start your job because you realised with concern that you only have a few decades of life left?

A toddler has not yet developed a realistic concept of death and is thus not yet aware of the finite nature of his or her life.<sup>109</sup> Nevertheless, as parents can attest, he or she usually does not sit the day away apathetically but explores his or her surroundings with enthusiasm.

Just like a toddler, a fascinated scientist or a passionate artist would love nothing more than to have unlimited time to study what excites him so much. He should not need any further motivation to do so, and certainly not the thought that he will eventually die.

If anything, death is a demotivator - a reason to stop all efforts and endeavours and enjoy what one has worked for before for a few more years before death puts an end to everything. aging reinforces this effect - it calls to mind that we will still be alive one day but no longer be able to play with our grandchildren, travel or take up a new hobby because our bodies will have degenerated.

Of course, as today, there will be things in the future that simply have to be done, even though no one feels like doing them. But in the same way, the extrinsic incentives for doing them that exist today will remain - such as deadlines, an impending dismissal, one's own needs, money and dozens of others. In any case, as should be clear from the above examples, the hitherto fixed limitation of human life by aging is certainly no reason for people today to get unpleasant tasks over with.

### **What happens to memories? Doesn't our brain run out of space at some point?**

Two counter-questions to clarify.

First, do you still know as many phone numbers as you did 20 years ago? Most likely not, and that's not because you're 20 years older but because you have better external tools than you used to. This trend will only continue.

Secondly, do you remember the names of most of the children you went to school with? If you are older, the answer is almost certainly no. In middle age, we already forget things as fast as we learn new things - and since recalling a memory automatically reinforces it, the things we forget are the ones we stored a long time ago and haven't recalled since, so they weren't relevant to us during that time. Since our memory is already in equilibrium, there is no reason to believe this will be any different in a longer or indefinite life span.

## The ageless world in books and films - realistic?

The world without aging is predominantly depicted in dystopian terms in fiction - whether it is books, films, games or any other medium. There aren't too many works that deal with the subject at all, but the few that do are built up by implying, without any justification or even an attempt at discussion (that's how they get away with not justifying it), that overcoming aging will bring a new problem that we can't solve without doing more damage. This is no great surprise: books and films are supposed to sell. Science fiction in particular, has to generate suspense for this in most cases. This works best by presenting a conflict right at the beginning, which escalates throughout the story - regardless of how plausible the conflict is in the real world. Such a conflict would not necessarily require dystopian conditions due to agelessness. Still, the book or especially the film is even more successful if it confirms the audience's preconceptions - in this case, the view that victory over aging would be a bad thing. The problem with this is that the portrayal of a fictional subject has a neutral influence on popular attitudes. In this case, it is a factor that reinforces the pro-aging trance, making it more difficult to develop therapies to reverse aging. Therefore, we decided to look closely at a few famous examples.

Book: "All men are mortal".

Plot: The novel by Simone de Beauvoir is about an Italian named Raymond Fosca who becomes immortal through a magic potion he receives from a beggar. Through this he experiences several centuries of European history. Still, he observes that base motives such as hunger for power are always repeated, and all efforts to improve people's lives in a lasting way are doomed to failure. No goal or activity can permanently fulfil him, so he becomes increasingly afraid of his inevitable infinity and finally meets life only with indifference. The story ends with nightmares of Fosca, in which he and the mouse on which he tried the immortality potion before drinking it, populate the earth as the last living beings.

Rebuttal: Here the crucial differences with the abolition of aging are particularly obvious: agelessness would obviously not mean this kind of immortality. Humans would be able to voluntarily forego continuing treatment and, at least for some time, would still die involuntarily - from causes that are not age-related. Moreover, it can be assumed that most people will choose to extend their healthy lifespan against illness and death, and that our society will adapt to the new situation (see, for example, our response on the topic of work). So the scenario of watching someone close to you age and die over and over again and not being able to find a foothold has no relation to reality whatsoever and only serves as a means to an end in the story.

Film: "Desire" (original title "The Hunger")

Plot: The centre of this British horror film from 1983 is a pair of vampires named Blaylock. Both vampires must regularly drink human blood in order not to lose their eternal life. The male vampire, John, begins to age surprisingly one day. Both he and his wife Miriam seek advice from gerontologists, but they cannot help him. Instead, he ages and ages faster and faster. But since he cannot die, Miriam stores him in a coffin in the attic next to her former partners, who have also



begun to age after several centuries in her presence. Miriam seduces the gerontologist Sarah a little later and lets her taste her blood, which also makes her immortal. Sarah gets hungry for human blood. After she has therefore killed her own lover, she goes to Miriam and cuts her carotid artery, whereupon she also wants to take it to the attic. When she tries to do so, her companions jump out of their coffins and attack her. Miriam tumbles down the stairs and begins to age rapidly as well, while her undead companions turn to dust.

Rebuttal: Aside from the sometimes bizarre horror elements, the basic premise, when tested for real-world plausibility, is due to a mixture of the Tithonus Fault and the idea of complete immortality, which, as explained, is something entirely different from agelessness.

Film: "In Time - Your Time Is Running Out" (original title "In Time").

Storyline: In this famous US science fiction thriller from 2011, a new global economic system exists in which lifetime serves as currency. Like money, it can be earned, spent, given away and stolen. A certain genetic manipulation ensures that people no longer age after their 25th birthday. In order to avoid overpopulation, people are left with exactly one additional year of life. The remaining time is indicated by a clock implanted on the forearm as a countdown. When the time is up, the wearer dies instantly. The population consists of a few super-rich who live pretty much forever and the mass of poor who die early. The planet is divided into different "time zones" where the different social classes live.

The simple worker Will Salas is given all of his time by a super-rich man. The head of the corrupt police authority does not like this transaction, however, because Will begins to generously give away his time to the needy, putting the entire economic system of the future in jeopardy. A fierce race against time begins.

Rebuttal: See especially our answer to the question, "Won't only the rich and powerful be able to afford this?" - here a more direct rebuttal.

The scenario presented is both technologically and socially implausible. The medical conquest of aging, as explained in the "Feasible" category, will not take the form of a single, permanent "cure" for aging, as we have for many infectious diseases, and certainly not by a simple genetic on/off switch: that is not how aging works and that is not how it can be medically controlled. It is possible that the aging process can be slowed down somewhat by a series of drugs that affect metabolism, but it cannot be reversed, and in any case it cannot be used to maintain a certain biological age.

aging is caused by the accumulation of molecular and cellular damage to our organs and tissues, which must be repaired, removed, replaced or rendered harmless one by one through targeted interventions. After these interventions, however, the damage will soon accumulate again, as we explained above. Therefore, people will have to undergo all these therapies again and again at regular intervals throughout their lives.

Because the SENS approach is like a mosaic and consists of many individual treatments that need to be put together, individual interests will work in our favour and prevent any attempt to

monopolise the first generation of SENS therapies or their refinement. The reason is that each company will have to promote its own product and, in addition, maximise the returns from each of several such products. This undermines any incentive for any of the parties to withhold the release of any particular product (if, hypothetically, they should have a collective interest in letting more people get sick so they can treat more patients).

Every industrialized country on earth - even the United States in its own way - funds health care significantly: most governments in industrialized countries fund the entire health care system, and even in the US they run Medicare,<sup>94</sup> the public health insurance for almost everyone over 65, and Medicaid<sup>110</sup> provides it for free to the poor.

And they do this with immature, ineffective, and expensive medicine that keeps people who are still aging temporarily alive in a very costly high-risk status where they cannot contribute to the economy. The cost of caring for people with Alzheimer's, Parkinson's and other diseases of old age is so high that insurance companies will almost certainly use tapering therapies because it is cheaper for them to prevent people from developing these diseases than to pay for the care of people who are already ill. And if private insurance companies don't do it, governments certainly will, because it will not only save them money on health care, it will also make social security and similar state pension schemes redundant, reduce the incidence of road accidents, keep productive workers in their economies, and so on and so forth - and because their voters will demand it unconditionally.

Film: "Death Becomes Her" (Original title: Death Becomes Her)

Plot: This 1992 US black comedy is about two women who are given a potion by a sorceress that is supposed to guarantee them eternal youth. Unfortunately, however, it also makes them immortal, which means that the two women live on and cannot die, despite the most serious injuries and disfigurements to their bodies.

Rebuttal: As in the first example given in this article, it quickly becomes clear that this scenario is impossible in reality. To continue to be alive despite severe destruction is physically, chemically and biologically impossible, since life requires countless bodily functions that can no longer be fulfilled if the body is destroyed. The abolition of aging is certainly comparable to the part of "eternal youth", however - as already mentioned several times - it cannot be equated with immortality in the sense of being unable to die.

Others:

In fact, most of the other books and films that deal with this subject matter are true either of the points noted so far in this section or of our answers to the questions "Will this make us immortal?", "What about overpopulation?" and "Won't only the rich and powerful be able to afford it?". In the case of the film "Elysium" it is mainly the latter point, in the case of the series "Altered Carbon" likewise, in the case of "Escape to the 23rd Century" the answer to the objection "Overpopulation". Century" the answer to the objection of overpopulation as well as the refutation to the film "In Time - Your Time Is Running Out", with "Highlander - There Can Be Only One" the answer to the

question of immortality as well as the refutation to "All Men Are Mortal", and with "Blade Runner" again the answer to the overpopulation question as well as an obvious mixing of the topic of agelessness with other science fiction topics (increased physical powers and intelligence) that have no connection with it.

## Conclusion

Whichever way you slice it, it is clear that the widespread fundamental aversion to age-fighting and healthy life-extension therapies is based on a web of instinctive assumptions and false premises. Our aim is to clear up the main misconceptions and prejudices. We hope that after reading this article you will now have a more complete picture of the issue, be able to form a more informed opinion based on this, and take possible action depending on this opinion!

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