



IMMORTALITY: A BLESSING OR A CURSE?

Konstantina Strep¹

¹ Master's student Biomedical Sciences, Radboud university medical center, Nijmegen, The Netherlands

The search for immortality has interested people for many centuries, with a great example being the famous painting 'The Fountain of Youth' created by Lucas Cranach in 1546 (Figure 1) [1]. This painting depicts older women who can barely walk, diving into a magical fountain, and emerging as younger and rid of their age-related defects. Nowadays, scientists are getting closer to discovering this magical fountain by exploring anti-ageing treatments that might increase your lifespan. But as we are so close to finding that recipe, would you like to slow down this process? Or would you rather dive into 'The Fountain of Youth' and meet immortality?

The road will end, prepare to die

Before we find the solution to ageing, we first have to understand why we become old and eventually die. All of us have 23 pairs of DNA, called chromosomes, in each cell of our body [2]. Each chromosome has special caps at its ends, the telomeres, which can protect the chromosome from damage [3]. When a cell divides during your life, the DNA inside the cell is copied to a new cell [2]. However, not all genetic material can be copied, and the chromosomes in the cell start becoming shorter [4]. The genetic material only becomes shorter at its ends, initially affecting the size of telomeres but eventually affecting essential DNA sequences as well [4]. The cell is not stupid. When its chromosomes get shorter and shorter, the cell will randomly decide not to divide anymore in order not to be destroyed, a concept known as cellular senescence [5]. And this is how ageing occurs [6]. Imagine ageing as a signal that turns healthy people into zombies. Zombies will stop functioning normally and will start causing various problems to the surrounding environment. They will chase surviving people and bite them to turn them into zombies as well. The more zombies are present in town, the bigger the damage and the faster the whole town will disappear. In this example, the town represents the human body, with zombies representing the non-dividing 'old' cells of our body that will chase and destroy the 'survivor' healthy cells. These 'zombie cells' are found to be responsible for ageing and will internally program us to die.

Anti-ageing drugs on Amazon

However, ageing itself is not the biggest problem, rather age-related diseases which can make your road to death even shorter. Scientists around the world are trying to solve the puzzle of ageing to avoid this decline. They try to find cures that aim specifically to fight the 'zombie cells' in our body or even keep telomeres longer so they can still protect the cell from damage. The battle against 'zombie cells' can be easily reinforced by 'superfoods' [7]. Some of these nutritional heroes are hidden in your food, such as Vitamin A or Vitamin C, which can save your body by scavenging the bad cells. Of course, if you eat all your vegetables during your dinner or a lot of fruit during the day, it does not mean that you will suddenly become ten years younger. However, it does mean that you could buy for quite some time until you reach your final destination. Another way of battling ageing is more complicated since you also have to use some drugs. There are several drugs on the market, even found on Amazon, that claim to keep your chromosomes long and, therefore, keep you young. These drugs are based on a molecule found in the Chinese herb plant *Astragalus membranaceus* [8]. When you orally ingest the drug, it circulates in your blood and eventually enters the old 'zombie

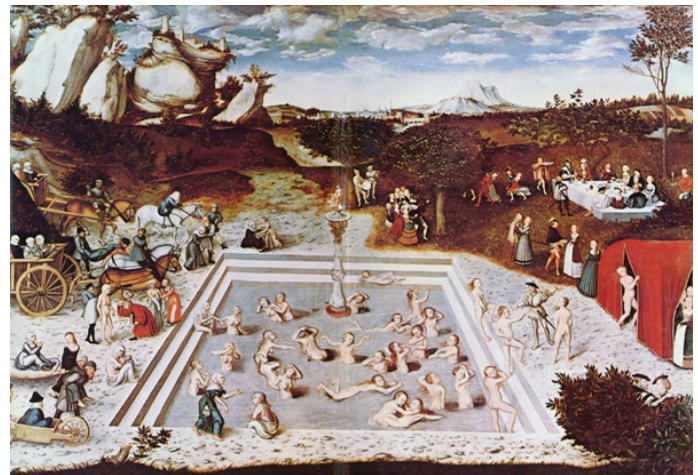


Figure 1: 'The Fountain of Youth' painted by Lucas Cranach in 1546

cells' of your body. In there, it wakes up the guy who is responsible for making telomeres, the telomerase enzyme. Telomerase then starts working to make chromosomes longer and cells healthy again. However, such treatments might be too good to be true.

Warning, danger zone!

If you examine the painting of 'The Fountain of Youth' (Figure 1), you will notice a man, dressed in red and holding a book, trying to warn a lady before she jumps into the magic water. He might be a doctor or a crazy scientist. Contemporary scientists are actually trying to do the same. They warn us that all these anti-ageing drugs are not tested for long-term effects and might even have many dangerous side effects. However, some companies want to benefit from the attractive idea of anti-ageing and increase their profits by bringing these products to the market. But what do laypeople think about living in an immortal world? Journalists of the journal 'New Scientist' were curious enough to survey more than 2,000 British people on the topic of longevity [9]. The outcome was quite surprising since only 20% were positive towards this concept. Why would modern-day people 'reject' immortality? As it turns out, living forever hides many dangers.

Listen to the experts

"A lot of the value of life is drawn from its finite character. If you could truly always postpone everything until tomorrow, will you ever do things?" says Bart Penders, associate professor from the Department

of Health Ethics & Society at Maastricht University. "If we achieve immortality, the view of life and what life is will change. Everything and every personal relationship will get senseless", adds Jos Kole, assistant professor from the Department of IQ Healthcare Ethics at Radboudumc. Imagine a world in which everybody lives forever, where you have the same conversation with the same neighbours, every single morning, for your whole infinite life. Such a life is not so interesting anymore. "But of course, if everybody lives forever, then practical problems will arise too", warns Kole. If nobody dies, the Earth will run out of space and resources to sustain all human life, and eventually we would have to settle ourselves on a different planet. In addition, critical questions about the organisation of society would arise. Kole explains, "If we find the cure to ageing, who will it be available for? Who will decide who gets the treatment? How much more expensive will healthcare become?"

After what has been said so far, you might think that we are coming closer to finding the real 'Fountain of Youth'. However, with the oldest person alive today being 118 years old, we still have a long way to go until we can truly escape ageing. "Extending life is feasible, we are doing it now, but eternal life is still science fiction", concludes Kole. For now, enjoy the journey as long as it lasts.

Acknowledgements

RAMS would like to thank Jos Kole, PhD, and Bart Penders, PhD, from the Department of IQ healthcare Ethics at Radboudumc and the Department of Health Ethics & Society at Maastricht University, respectively, for providing the author with feedback. Also, RAMS thanks Britt Thomassen for performing the interviews together with the

author. In addition, RAMS would like to thank Daphne Olischläger, BSc, for reviewing the article. Lastly, RAMS would also like to thank Konstantina Strep for her contribution to RAMS' edition 18.

References

1. Katalog der Gemäldegalerie Berlin. Berlin-Dahlem 1975, S.118f
2. Ford, C. E., & Hamerton, J. L. The chromosomes of man. *Acta genetica et statistica medica*, **6(2)**, 264-266 (1956).
3. Blackburn, E. H. Structure and function of telomeres. *Nature*, **350(6319)**, 569-573 (1991).
4. Aubert, G., & Lansdorp, P. M. Telomeres and aging. *Physiological reviews*, **88(2)**, 557-579 (2008).
5. Muñoz-Espín, D., & Serrano, M. Cellular senescence: from physiology to pathology. *Nature reviews Molecular cell biology*, **15(7)**, 482-496 (2014).
6. Gil, J. Cellular senescence causes ageing. *Nature Reviews Molecular Cell Biology*, **20(7)**, 388-388 (2019)..
7. Milisav, I., Ribarič, S., & Poljsak, B. Antioxidant vitamins and ageing. *Biochemistry and Cell Biology of Ageing: Part I Biomedical Science*, 1-23 (2018).
8. Liu, P., Zhao, H., & Luo, Y. Anti-aging implications of Astragalus membranaceus (Huangqi): a well-known Chinese tonic. *Ageing and disease*, **8(6)**, 868 (2017).
9. Only one in five UK adults would choose to live forever if they could [internet]. Newscientist.com. 2018 [cited: Jan 28, 2020]; available from: <https://www.newscientist.com/article/2179928-only-one-in-five-uk-adults-would-choose-to-live-forever-if-they-could/>.

EXAM QUESTIONS

As RAMS aims to enlighten both students and professionals, we would like to present you two exam questions. Find out if you can remember what you have learned during your bachelor's!

We challenge you!

Question 1

During the acute phase reaction of an infection, the serum concentration of C-reactive protein and other so-called "acute phase" proteins increases. What is the stimulus for the increased production of acute-phase proteins?

- A. Cytokines released by macrophages
- B. Expression of integrins and selectins on the endothelium
- C. Synthesis of reaction oxygen species in mitochondria

(Topic from Q2 The Immune system, 2019)

Question 2

Antagonistic pleiotropy is one of the mechanisms of ageing. An illustrative example of antagonistic pleiotropy is that:

- A. APO lipoprotein allele epsilon 4 is necessary for fat metabolism at a younger age, whereas it increases the rate of developing Alzheimer's disease at an older age.
- B. Patients develop a productive cough during pneumonia, which can cause a delirium in the elderly.
- C. Hypertension forms a risk factor for heart- and vessel disease, but hypertension also supports the ongoing vascularisation of the brain at old age.

(Topic from Q2 MGZ Aging, 2019)

The answers to these questions can be found on page 29 in this journal.