

Living for a Millennium: Fact or Fiction?

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In today's day and age, a person who lives until 100, lives a full life. Yet, only until recently have we been able to fathom such longevity. In fact, 200 years ago the average life expectancy of a typical male was a mere 47 years old. [1] This reality makes it very difficult to comprehend that people could have lived almost a millennium. We do see, however, that in the *Tanach* it is recorded that the first ten generations of humanity lived well over 900 years. For example, the longest ever recorded lifespan is attributed to *Metushelach*, who lived to the ripe old age of 969. Additionally, it seems that the first ten generations of humanity did not age, as some of them had kids very late in life. Male fertility usually decreases at age 45, yet *Noach* sired his children when he was 500 years old. How could this be?

This question perplexed many religious scholars and scientists for generations and, up until recently, it was very hard to offer a scientific rationale. With the growing interest in the science of aging, scientists discovered that human aging is not a result of the body wearing itself out, but the result of genes coding how long humans can live (excluding any environmental influences). Controlling those genes may be one of the keys to understanding longevity in the time of *Tanach*.

When human cells duplicate their DNA, their telomeres get shortened in the process. Telomeres are the ends of the coding sequence in DNA, and the enzyme telomerase is responsible for elongating the telomeres. If the telomeres are too short, the DNA will not duplicate, halting the cell's ability to replicate itself. In cancerous and stem cells, for example, the enzyme telomerase is activated, which allows the cell to duplicate itself indefinitely. In 1997, two scientists published an article called "News in Brief" in the *Scientific American* reporting that they discovered the gene that controls telomerase. These scientists claimed that controlling this gene could be the key to allowing cells to duplicate indefinitely, thereby allow humans to live forever.

Cells reaching their Hayflick (replicating) limit, however, is not the only reason why we age; therefore,

discovering the gene that controls telomerase is not convincing proof that humans could live indefinitely. Other researchers found that controlling different genes, besides for the gene that controls telomerase, can also prove that genes control longevity. Professor Tom Johnson of the University of Colorado discovered that by changing one gene, *age-1*, in the nematode worm (*Caenorhabditis elegans*) the average lifespan of the worm increases twofold [2]. Professor Michal Jazwinski discovered that integrating the *LAG-1* gene into yeast (*Saccharomyces cerevisiae*) not only increases the lifespan of the yeast, but allows the yeast to stay younger for longer and have offspring for a bigger range of years [3].

Professor Leonard Hayflick explains in his article *How and Why We Age* that there are some species that do not age at all, but only die because of external environmental reasons (i.e. something steps on them). He writes that "some animals do not age at all. If they do age, it occurs at such a slow rate that their aging cannot be demonstrated. Non-aging animals experience a peak in their physiological function at some point, but these functions do not seem to decline... non-aging animals do not live forever because of accidents, disease, and predation" [4]. For example, the Andean condor (*Vultur gryphus*) has been recorded to lay eggs at age 80 and show no signs of aging [5]. Living a long time and reproducing in what is conventionally considered an old age is not unique to animals, but applies to plants as well. For instance, bristlecone pine trees (*Pinus aristata*) live over 4,000 years, and yet every year they produce seeds that will eventually become new trees [6] [7].

How do we reconcile these scientific findings on the longevity of plants and animals with the fact that the average modern human does not generally live over the age of 100? When discussing what causes humans to die, *Rambam* writes that humans only die because of external environmental factors [8]. Natan Aviezer, author of the *The Extreme Longevity of the Early Generation in Genesis*, suggests that when *Adam* was created, he was created as the perfect man with an immaculate and immortal genome. The reason that *Adam* was immortal

was twofold: he had the perfect genome, and he was in the perfect environment. When *Adam* was in the Garden of Eden, there were no environmental factors that could cause him to die. However, once *Adam* left the perfect environment, he was exposed to an environment where he could be killed. Aviezer proves this by quoting a *pasuk* from *Bereishet* 2:17 where *Hashem* says that “as for the tree of knowledge of good and bad, you must not eat of it; for as soon as you eat of it, you shall die.” When *Hashem* says to *Adam* that he will die if he eats from the Tree of Knowledge he does not mean he will die immediately, but that being expelled from the Garden of Eden will thrust him into an environment where it is possible for him to die [7].

If this is true, and *Adam* had the perfect genome, why did the lifespan of mankind plummet after *Noach's* generation? There are three possible suggestions to resolve this problem. The first explanation is that after the *Mabul*, the climate of the world changed so much that it was less habitable for people, and therefore decreased human life expectancy [9]. However, the issue with this proposal is that the human life expectancy did not drop immediately to 120 from 900, but was a steady decline of longevity. If it was truly the environment that was the cause of the decline in human life expectancy, human longevity would have decreased immediately.

The second option is one that can be explained through epigenetics. In 1988, a study was conducted on a secluded population in the town of Överkalix in northern Sweden. Due to the town's remote location, the food supply for the year was completely dependent on the success or failure of the town's yearly harvest. If it was a year where less food was harvested, the people in this town would simply starve due to lack of resources. This study showed that the descendants of the people who went from living in a time of good harvest to that of one where there was a sparse harvest, lived on average six years less than that of the descendants of the people who lived through years of starvation and then transitioned to years where there was more food available. The study suggested that the genes that were necessary for living were not altered or removed from the people's genome, rather they were methylated and the genes were silenced [10]. Based on these findings, one can suggest that after the trauma of the flood, having to shelter in a boat for a year, and then the world being restored to its natural order *Shem*, *Cham*, *Yafet*, and their

respective spouses, each had vastly different reactions to these events. As a result, each survivor would pass on a genetic code that was individually methylated and subsequently coded for a unique longevity. As the generations progressed, more people married and therefore diluted the genes that code for over 900 years of life, effectively decreasing the longevity of each generation. This, combined with mankind's inability to control his environment and how he is affected by it, caused the life expectancy of the human population to decline [1].

The *Talmud* (Hagigah 13b-14a) suggests a third explanation. According to the *Talmud*, despite the fact that *Adam* had the perfect genome, he was not the first man to exist, and that 974 human generations existed before him. Because *Adam* had the perfect genome, his descendants separated themselves from the rest of mankind and married each other so that they could preserve the perfect genome and all live for as long as possible [11]. This is proven from *Cain's* fear seen when he is forced to wander the earth and cries “anyone who meets me may kill me!” (*Bereisheit* 4:14). The fact that *Cain* thinks that he can encounter new people for the first time proves that there are other people on the earth besides his family, who all already know who he is. After the *Mabul*, however, there was almost nobody left from *Adam's* family and his descendants started to intermarry with the tribes they found in the place that they landed after the flood (some sources say present day Iraq). As a result, the longevity of *Adam's* family decreased and was ultimately eliminated, and equalized *Adam's* descendants' longevity with that of the rest of mankind [12].

In *Sefer Yeshayahu*, *Yeshayahu* prophesied that when *Mashiach* comes, “No more shall there be an infant or graybeard who does not live out his days. He who dies at a hundred years shall be reckoned a youth, and he who fails to reach a hundred shall be reckoned accursed” (*Yeshayahu* 65:20). Many *mefarshim* explain this prophecy to mean that someone who dies at age 100 will be considered a teenager [13]. In *Tanach*, a teenager is considered to be 13 years old, so if a teenager is now considered to be 100 years old, that means that the human life expectancy multiplied by 7.7, making it about 923 years [14]. 923 is very similar to the life expectancy of those first 10 generations who were descendants of *Adam*, leading *mefarshim* to say that when *Mashiach* arrives, humankind will go back to living the lifespan of *Adam* and the 10 generations after him [14] [15].

The fear of death is what allows human beings to live their life to the fullest, and one has to wonder: is living for a millennium something one should strive for, or something that we should be thankful was eliminated generations ago? Only time will tell.

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- [11] *Pirkei de-Rabbi Eliezer* 21(48a-b); Rashi on *Leviticus* 20:17, based on *Yevamot* 62a and *Sanhedrin* 38b; see *Tosafot* *Sanhedrin* 38b, s.v. *va-yardu*; *Beriesheit Rabbah* 22:3
- [12] *Genesis* 11:2 (see *Rosh/Tur HaAroch*)
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