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Article

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Exponential Decay of Biblical Longevities

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The Hebrew Bible is often read that men once lived nearly a thousand years. Then, after a cataclysm in the form of a flood, their life spans followed an exponential decline to contemporary values, but no explanation for this decline was offered. Recently, it has been suggested that the decline can be attributed to marriage of the descendants of Noah to a population of short-lived survivors of the flood. This journal has previously published a paper that argued that the numbers expressing these longevities have the properties of real numbers and none of the properties of artificial or made-up numbers, and that the reasons for doubting the biblical numbers do not survive close examination. Moreover, recent work argues that humans may ultimately have biblical longevities. The present article shows that the intermarriage explanation for the decay of longevities is plausible.

Keywords: evolution, longevity, life span, Bible, negligible senescence

The Hebrew Bible, accessible as the Old Testament of the Christian Bible, reports that, early in history, men consistently lived an average of 912 years. Then the Bible reports that a cataclysm in the form of a flood killed everyone except for a single family consisting of a man (Noah), his wife, their three sons, and the sons' wives. After that, the life spans of those reported by the Bible decayed exponentially down to an asymptote of 71.7 years,¹ close to contemporary values. These longevities might be hard to accept, but a paper published in this journal argued that the numbers representing them have the properties of real data and none of the properties of made-up or artificial numbers.² The same paper continued that the reasons for doubting the truth of these longevities do not hold up to close examination.

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Mathematical Properties

The paper cited above starts by pointing out that natural data and manufactured numbers have different properties. The most important property of natural data is that they follow Benford's law,³ a property that has been accepted in court to distinguish between real and falsified data.⁴ Benford's law states:

$Pd = \log_{10}(1 + 1/d)$, where Pd is the probability that the first digit of any number in a set of naturally occurring numbers is d .

For example, if we take the longevities cited in the Bible as a set of naturally occurring numbers, the probability that the first digit in any one of those numbers is 4 is $\log_{10}(1 + 1/4) = \log_{10}(1.25) \sim 0.0969$.⁵

The paper cited above shows that the biblical longevities follow Benford's law, but that they deviate from a uniform distribution,⁶ and that they also deviate from the distribution of numbers offered by humans asked to produce random numbers.⁷

Natural data also represent systematic processes perturbed by random error, these perturbations tend to be mutually independent, and the distribution of the perturbations tends to be Gaussian. As reported by Makous, the biblical longevities have these properties of natural data.⁸ One cannot say that these properties are inconsistent with all forms of fictional data, but they do strengthen the idea that the biblical longevities represent real instead of fabricated numbers.

Reasons to Doubt the Biblical Longevities

A principal reason for doubting such longevities is that they transcend our own experience: the longest documented human life span is 122 years and 164 days.⁹ However, what limits life spans today need not always have done so. To take an example that illustrates the fact that a change of environmental conditions can dramatically affect the rate of aging, 60% of the cosmic rays that bathe the earth and damage our DNA arise from the afterglow of the monogem supernova, the effects of which reached Earth 86,000 years ago.¹⁰ This particular event of course explains neither the magnitude nor the time course of the change in human longevities, but it is presented here to show that conditions that affect longevity can change.

Another reason for questioning the biblical longevities is that there is no archeological evidence for them. However, archeologists estimate biological age, not chronological age. The biblical life spans could have occurred only if they were associated with a retarded rate of aging.

Finally, there seems to be a dearth of reliable records of such longevities outside the Bible. However, the records that go back far enough in time actually do agree with the biblical longevities: the Roman historian, Josephus cited eleven specific authors to support the statement that, "All who have written antiquities ... relate that the ancients lived a thousand years."¹¹ These sources are widely regarded as unreliable, but the principal reason that they are regarded as unreliable is that they seem implausible, which of course begs the question.

It is also relevant here that recent work supports the idea that humans might live to the advanced ages

described in the Bible, though the emphasis of that work is on the future instead of the past.¹²

Explanations That Do Not Work

Explaining both the magnitude and the time course of the decay of longevities has been a challenge. Carol Hill attempted to resolve the problems posed by the long patriarchal longevities by denying their quantitative meaning. According to Hill,

The key to understanding the numbers in Genesis is that, in the Mesopotamian world view, numbers could have both real (numerical) and sacred (numerical or symbolic) meaning. The Mesopotamians used a sexagesimal (base 60) system of numbers, and the patriarchal ages in Genesis revolved around the sacred numbers 60 and 7.¹³

Makous explains some of the problems posed by this approach.¹⁴

John Walton went more deeply into the differences between the Mesopotamian number systems and that in Genesis.¹⁵ To reconcile the two lists of patriarchs, Walton made three changes: (1) he omitted some members from the biblical list to bring the number of patriarchs in the Genesis list into coincidence with that of the Mesopotamian list; (2) he ignored the clear statement in Genesis that the biblical longevities overlapped and instead treated them as though they were sequential, as the Mesopotamian list is; and (3) he translated the Mesopotamian longevities from a putative base 6 notation into the decimal system used in Genesis. Instead of comparing the resulting individual longevities in the two lists, he simply compared the total longevities of the two lists. When he did this, he found that the sums of the two lists of longevities were close (6695 versus 6700). Though they were not equal, he nevertheless treated them as though they were.

So, truncating one list to bring the length of the two lists into agreement, treating the list of overlapping longevities as though they were successive, and accounting for the putative differences in the base number led to two lists with nearly the same but slightly different sums. This led Walton to conjecture that the two lists have a common tradition. Readers may agree with me that such is not warranted by the evidence.

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Taking a different approach, Fazale Rana and Hugh Ross have examined six variables that are known to extend life.¹⁶ However, if all six variables work in humans as well as they work in the animal experiments, and if the effects are linearly additive, they collectively account for only 40% of the observed extension in longevities.

The Intermarriage Hypothesis

No acceptable explanation of the decline in life spans had been offered until Richard Fischer suggested that those who survived the flood can be separated into two populations:¹⁷ (1) the descendants of Noah, who had slow aging and long life spans, like animals that exhibit *negligible senescence*;¹⁸ and (2) a different population that were separate from Adam’s descendants, who had more rapid aging and much shorter life spans. The purpose of the present note is to test the plausibility of this intermarriage explanation.

In the inheritance of polygenetic traits, such as longevity, it is equally likely that the traits of the mother and of the father will be inherited, so that the child of a long-lived parent and a short-lived parent will, on

average, have equal numbers of genes for long life and for short life, and the expected longevity of the child is the mean of those of the two parents. This can be seen in any of the many recommendations for computing the expected height of a child from the heights of its parents.

Let us first consider the possibility that all Noah’s descendants (the Bible treats only the longevities of males) married women who were not Noah’s descendants. The Bible lists the life spans of 18 males distributed over 16 successive generations after the flood (see table 1). These are represented by the black symbols in figure 1 while the predictions based on wives not being descendants of Noah are represented by the white symbols. It is obvious that this theory does not fit the data. To fit, what is needed are generations with long life spans, to retard the decrease in life expectancies.

Perhaps some of Noah’s descendants had mothers who were the progeny of Noah’s other sons. For example, Noah’s wife, the mother of his children, could have decreased the children’s life expectancies if her own mother were not a descendant of Adam. That is, she was at least half a descendant of Adam, for Noah married the daughter of his cousin, who would have been Adam’s descendant; but she might

Names	Generation	Theory	Data
Shem	1	720.9250000	600.0
Arphaxad	2	396.3125000	438.0
Sahal	3	396.3125000	433.0
Eber	4	396.3125000	464.0
Peleg	5	234.0062500	239.0
Reu	6	234.0062500	239.0
Serug	7	234.0062500	230.0
Nahor	8	152.8531250	148.0
Terah	9	152.8531250	205.0
Abram	10	152.8531250	175.0
Isaac	11	152.8531250	180.0
Jacob	12	152.8531250	147.0
Levi & Joseph	13	112.2765625	123.5
Kohath	14	112.2765625	133.0
Amram	15	112.2765625	137.0
Aaron & Moses	16	112.2765625	121.5

Table 1. Longevities of the Descendants of Noah

“Theory” is the longevity arrived at within the text; “Data” is the longevity reported in the Bible. The longevities listed for Levi and Joseph and for Aaron and Moses are the means of each of the two.

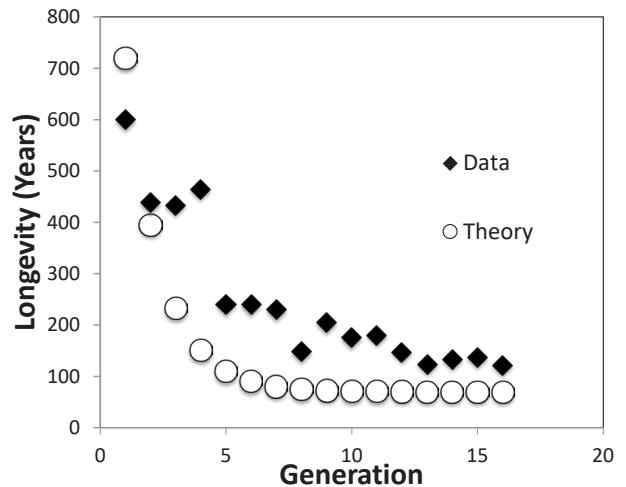


Figure 1. Longevities of Successive Generations after Noah’s Generation: Mothers All Short-Lived. The black symbols represent the live spans reported in the Bible, and the white symbols represent the life expectancies based on the assumption that all males married short-lived women spared by the flood. The abscissae are the generation number minus the number of Noah’s generation. Levi and Joseph were brothers, and so the life span of generation 13 is the mean of their lifetimes, 137 and 110 years, or 123.5 years; and Aaron and Moses also were brothers, and so the life span of generation 16 is the mean of their lifetimes, 120 and 123 years, or 121.5 years.

have had a mother who was not a descendant of Adam, which would make her own life expectancy equal to the mean of her father's long-expected longevity and her mother's short-expected longevity: $(912 + 71.7)/2 = 491.85$ years. Then the expected longevity of Noah's son, Shem, would have been the mean of Noah's life span¹⁹ and that of his mother: $(950 + 491.85)/2 = 720.925$ years.

Let us assume that Shem also married a woman from the short-lived population. This corresponds to the statement in Jubilees that she had a name that was not of Adam's tribe (Sêdêqêtêlêbâb).²⁰ So the expected longevity of Shem's son, Arphaxad,²¹ would have been the mean of Shem's expected longevity and the expected longevity of this short-lived wife: $(720.925 + 71.7)/2 = 396.3125$ years. It would take about three more non-Adamic mothers to bring the expected longevity down to near 121.5 years, the life span at the end of this series of consecutive life spans.

The question, then, is where, in this sequence, those three short-lived mothers are most likely to have occurred. They would most likely be in the generations immediately preceding those in which the decreases in life spans are greatest. That would be generations 4, 7, and 12. The other generations would have mothers who are descendants of Noah's other sons, whose expected longevities are equal to those of Noah's descendants of the same generation. These theoretical longevities are plotted as white circles in

figure 2, and the reported life spans are represented by the black symbols.

These assumptions of course may err in several ways. For example, I assume that all descendants that are part of a given generation have the same expected longevities, and I assume that all the males—other than those of generations 4, 7, and 12—marry females of their own generation.

Nevertheless, these assumptions do account for 92% of the variance in this set of life spans. This does not prove the assumptions on which this finding is based, but this finding does show that these assumptions are among those that are possible. The importance of this statement is enhanced by the fact that they are the only assumptions that have been offered, to date, that do account for the data. Then this suggests that the decline in longevities of Adam's descendants following the flood could well be due to their occasional marriage with short-lived women left by the flood, as suggested by Fischer. It also somewhat strengthens one's confidence in the truth of the biblical longevities.

Notes

¹Walter Makous, "Biblical Longevities: Empirical Data or Fabricated Numbers?," *Perspectives on Science and Christian Faith* 63, no. 2 (2011): 117–30, <https://www.asa3.org/ASA/PSCF/2011/PSCF6-11Makous.pdf>.

²Ibid.

³Alex Ely Kossovsky, *Benford's Law: Theory, the General Law of Relative Quantities, and Forensic Detection Applications* (Hackensack, NJ: World Scientific, 2015), 21; Mark Nigrini, "Digital Analysis Using Benford's Law: Tests and Statistics for Auditors," *EDPACS* 28, no. 9 (2001): 1–2, <https://doi.org/10.1201/1079/43266.28.9.20010301/30389>; and Frank Benford, "The Law of Anomalous Numbers," *Proceedings of the American Philosophical Society* 78, no. 4 (Philadelphia, PA: American Philosophical Society, 1938): 551–72, <http://www.jstor.org/stable/984802>.

⁴Kossovsky, *Benford's Law*; and Nigrini, "Digital Analysis Using Benford's Law."

⁵Benford, "The Law of Anomalous Numbers."

⁶Makous, "Biblical Longevities."

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⁹Jean-Marie Robine and Michel Allard, "The Oldest Human," *Science* 279, no. 5358 (1998): 1834–5, <https://doi.org/10.1126/science.279.5358.1831h>.

¹⁰S. E. Thorsett et al., "Pulsar PSR B0656+14, the Monogem Ring, and the Origin of the 'Knee' in the Primary Cosmic-Ray Spectrum," *The Astrophysical Journal* 592, no. 2 (2003): L71–L73, <https://doi.org/10.1086/377682>.

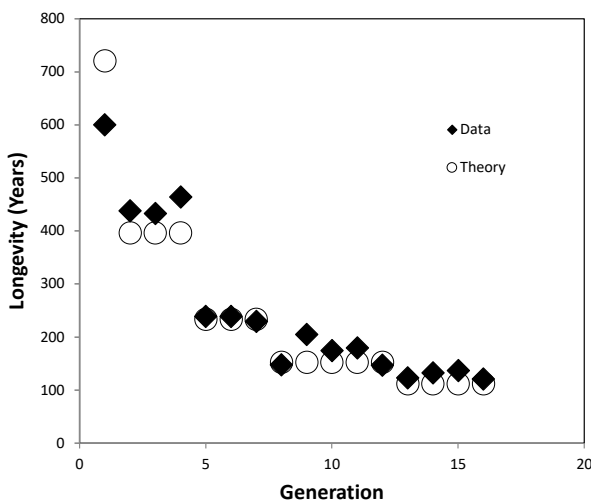


Figure 2. Longevities of Successive Generations after Noah's Generation: Mothers of Mixed Ancestry. The black symbols represent the life spans of successive generations after Noah, and the circles represent the theoretic values obtained by the assumptions in the text. "Generation" is as in figure 1.

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- ¹¹Flavius Josephus, *The New Complete Works of Josephus*, trans. William Whiston (Grand Rapids, MI: Kregel, 1999), 55.
- ¹²David A. Sinclair and Matthew D. LaPlante, *Lifespan: Why We Age – and Why We Don't Have To* (New York: Simon & Schuster, 2019).
- ¹³Carol A. Hill, "Making Sense of the Numbers of Genesis," *Perspectives on Science and Christian Faith* 55, no. 4 (2003): 239, <https://www.asa3.org/ASA/PSCF/2003/PSCF12-03Hill.pdf>.
- ¹⁴Makous, "Biblical Longevities."
- ¹⁵John K. Walton, "The Antediluvian Section of the Sumerian King List and Genesis 5," *Biblical Archaeologist* 44 (1981): 207-8, <https://api.semanticscholar.org/CorpusID:164300791>.
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- ¹⁷Richard James Fischer, *Historical Genesis from Adam to Abraham* (Lanham, MD: University Press of America, 2008), 62.
- ¹⁸Caleb E. Finch, *The Biology of Human Longevity: Inflammation, Nutrition, and Aging in the Evolution of Lifespans* (Burlington, ME: Academic Press, 2007), 373.
- ¹⁹Genesis 9:29.
- ²⁰*The Apocrypha and Pseudepigrapha of the Old Testament*, trans. R. H. Charles (Oxford, UK: Clarendon Press, 1913), scanned and ed. Joshua Williams, Northwest Nazarene College, Jubilees 7:16, <http://www.pseudepigrapha.com/jubilees/7.htm>.
- ²¹*Ibid.*, Jubilees 7:18.



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