Radiocarbon and the Longevity of Prediluvian Patriarchs

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Abstract

A successful scientific explanation for the long lifespans of prediluvian patriarchs has not yet been put forward. However, one overlooked possibility involves the negative role of radiocarbon (C-14) as a source of cancer-inducing mutations. Because radiocarbon is incorporated into the very atoms of the DNA strand, the transmutation of radiocarbon atoms back into nitrogen has a disproportionate ability to create mutations compared to other sources of radiation. If we accept that today's fossil fuel reserves were created by the burial of prediluvian forests and marine life, then the amount of carbon in the prediluvian atmosphere, biosphere, and oceans was much greater than at present. This means that radiocarbon produced from cosmic rays before the Flood would have been diluted into a much larger carbon sink, greatly decreasing the concentration of radiocarbon in humans, thereby lowering the rate of cancer, and allowing longer lifespans. To support this thesis, we will calculate likely levels of radiocarbon before and after the Flood and compare them with prediluvian and postdiluvian lifespans. Next, we will show that radiocarbon decay has the potential to cause the most cancers and be a significant factor in decreasing human lifespans. Finally, we will discuss future experiments and a way we can begin to increase human lifespan in the present. Isaiah prophesied, *"There shall be no more thence an infant of days, Nor an old man that hath not filled his days: For the child shall die an hundred years old; But the sinner being an hundred years old shall be accursed"* and *"for as the days of a tree are the days of my people…."* (Isaiah 65:20, 22c)

Simple Summary

The article proposes a scientific explanation for the **long lifespans of prediluvian patriarchs**, such as Methuselah who lived 969 years, by focusing on the role of **radiocarbon (C-14)**. The core idea is that C-14, a radioactive form of carbon, is incorporated directly into DNA, and its decay into nitrogen-14 causes damaging mutations that can lead to cancer and shorten life. Before the worldwide Flood, the Earth's atmosphere, biosphere, and oceans are believed to have contained a **much larger total amount of carbon**—including vast forests that later became fossil fuels. This **large carbon sink** would have diluted the naturally produced C-14 from cosmic rays, resulting in a **significantly lower concentration of C-14** in living organisms, thereby reducing the rate of cancer-inducing mutations and allowing for longer lifespans. The article uses C-14 dating of coal and fossil fuels to suggest pre-Flood C-14 levels were much lower than present, consistent with a recent Flood. It also connects the observed **gradual decrease in human lifespans after the Flood** in Genesis to a presumed increase in atmospheric C-14 concentrations as the carbon sink changed. Furthermore, the author suggests modern evidence like the **increase in cancer rates following mid-20th century hydrogen bomb tests** (which spiked atmospheric C-14) and the longevity in certain coastal "blue zones" (where air and food might have slightly lower C-14) support this hypothesis. The article concludes that testing this theory, possibly by growing food in low-C-14 environments and studying its effect on animal models, could not only validate parts of the Genesis account but also potentially **lead to ways to extend human lifespans today**.

Introduction

One reason people reject the historical accuracy of the book of Genesis is that there does not seem to be a clear scientific way to explain some of the historical claims made in the book. The most dramatic claim, of course, is the recent creation of life and the story of the worldwide Flood. However, various explanations, including the idea of an asteroidal impact which triggered an explosive release of subterranean water on the opposite side of the planet (countercoup point), among other explanations, have been advanced which seem to explain successfully the origin of a worldwide Flood. A seemingly similar event is even visible on the surface of Mars. A claim that does not seem to have been successfully addressed, however, is the longevity of prediluvian individuals. This is an important claim because it is testable and has enormous practical implications. If we could identify the reason antediluvians lived so long and we live so little, we should be able to use this information to greatly extend modern lifespans. This historical claim does not just appear in the Biblical book of Genesis, but also in other ancient texts such as the Sumerian King List of the late third and early second millennium BC. Analysis of those texts and their numbering system has shown fairly close agreement of the lifespans stated in those texts to those in the book of Genesis. The apparent discrepancies can be explained if one assumes that those who copied or translated the original document incorrectly assumed that the originals used the base 10 numbering system instead of base 60 (Lopez, 1998). For example, Methuselah lived 969 years. If one incorrectly assumes that the number 969 is in base 60 and translates it back to base ten, it would give 32,769 = (9 × 60 × 60) + (6 × 60) + 9. The ages in the list vary between 28,800 and 43,200, which is in the correct range for this assumption. Josephus, in his writings, mentions other ancient historians who also claimed that the ancients lived much longer than we do now. He wrote:

> But let no one, upon comparing the lives of the ancients with our lives, and with the few years which we now live, think that what we have said of them is false; or make the shortness of our lives at present an argument, that neither did they attain to so long a duration of life.…I have for witnesses to what I have said, all those that have written Antiquities, both among the Greeks and barbarians; for even Manetho, who wrote the Egyptian History, and Berosus, who collected the Chaldean Monuments, and Mochus, and Hestieus, and, besides these, Hieronymus the Egyptian, and those who composed the Phoenician History, agree to what I here say: Hesiod also, and Hecataeus, Hellanicus, and Acusilaus; and, besides these, Ephorus and Nicolaus relate that the ancients lived a thousand years. (Quoted from Eames, 2020)

Some explanations which have been advanced to explain the long lifespans include a canopy of water vapor or of some other substance that reduced radiation reaching the Earth, that a stronger magnetic field reduced the particle radiation reaching the Earth, that the canopy increased the pressure of the air or concentration of the oxygen, or that the genetic bottleneck caused by the Flood shortened the lifespans. All these explanations have problems associated with them. If the cause of aging is radiation, then by living in environments protected from radiation, it would be possible to live longer. For example, one could live underground where several meters of earth would provide protection from cosmic rays. Furthermore, humans are exposed to constant background radiation. Some of that comes from the sky in the form of cosmic radiation, and some comes from radioactive substances. The amount that comes from cosmic radiation is actually much less than what comes from radioactive substances, both in our bodies and in our surroundings. The same would be true with higher atmospheric pressures or higher oxygen concentrations. It would be easy to prove that such conditions increased longevity and, so far, that has not been the case. Furthermore, there is no conclusive scientific or Biblical evidence that a water vapor canopy existed, and computer models of such a water vapor canopy predict a world that is too hot to permit life (Vardiman and Bousselot, 1998; Worraker, 2020).

The genetic bottleneck theory also has problems because the stable, long ages associated with the prediluvian patriarchs point to a stable genome that was little affected by mutations. Genetic bottlenecks are more significant when there is an accumulation of genetic mutations. Furthermore, a genetic bottleneck cannot explain the shortening of the lifespan of Shem, who was born before the Flood. Also, the age continued to fall even as the population grew to a size that was large enough to be genetically stable.

One source of genetic damage, which I believe has been overlooked, is the direct effect of the decay of radiocarbon, also known as carbon-14 (C-14). When a cell receives radiation, that radiation may or may not break a bond in a molecule of DNA, causing a mutation. Often, the bond can be reformed, causing no damage. However, when C-14, which is part of a DNA molecule, decays, it will always cause damage to the molecule because C-14 now becomes a nitrogen-14 (N-14), and that substitution of one element for another destroys that particular nucleotide by changing it into a completely different molecule. In addition, the recoil from the emitted beta particle causes a break at that particular point. This paper posits that the decay of radiocarbon is, perhaps, the most important source of carcinogenicity, at least putting a floor on the incidence of cancer. Other factors can increase the rate of cancer, but it cannot decrease below a certain rate for a given historical population because of the effect of radiocarbon.

Prediluvian Carbon Dioxide Sink

Carbon-14 is a radioactive isotope of carbon which is found in all living organisms. It is formed as a result of the bombardment of the atmosphere by energetic cosmic rays. The primary component of cosmic rays is protons traveling at significant fractions of the speed of light. The most energetic cosmic rays have about as much energy as a tennis ball hit by a professional tennis player, but compacted into a size smaller than an atom (Hörandel, 2012). Most cosmic rays have about one thousand times less energy, which is still an enormous amount of energy. These protons crash into atoms in the atmosphere, and two things happen. First of all, they can break off pieces of the nucleus of atoms in air molecules, transforming them into lighter elements, particularly beryllium. This process is called spallation, and in addition to producing lighter nuclei, it also causes the ejection of energetic protons, neutrons, and alpha particles. Secondly, there is a process of amplification whereby the shower of small energetic particles and gamma rays produced by the original impact continues to collide with the nuclei of other atoms, expelling more energetic particles. For the purposes of this paper, an important component of this cosmic ray shower is the production of free neutrons. These neutrons slow down and bounce around in the atmosphere almost like a gas and are finally absorbed by nitrogen, which is a very good neutron absorber, unlike the other atmospheric gases. The fact that other gases are poor neutron absorbers is one reason why a water vapor canopy would not make a difference in the production of C-14 since the neutrons are only absorbed by nitrogen. The absorption of a neutron turns the nitrogen into C-14, which eventually combines to form radioactive $^{14}CO_{2,}$ which is taken up by plants and enters the food chain. We do not absorb radioactive $^{14}CO_2$ by breathing it, it must be consumed in food.

The standard Flood model holds that most of the coal deposits were vast prediluvian forests which were buried by the Flood, while oil and gas come from marine organisms buried by the Flood. Before the Flood, all of the carbon in fossil fuels was contained in living organisms, which served as a huge sink for C-14. Furthermore, the levels of carbon dioxide in the atmosphere would likely have been higher (Yapp and Poths, 1992). These two assumptions seem to be associated. Higher levels of CO2 seem to support higher levels of plant and animal life, and the corollary is also true; in order to explain the higher levels of plant life represented by the buried coal, higher levels of CO2 are necessary. This is consistent with what we are observing in the present as we gradually burn these fossil deposits and return this carbon to the biosphere. First, there is a measurable rise in atmospheric CO2 levels in the last century. This means that the biosphere does not absorb all the emitted CO2. However, secondly, we are also seeing an effect called carbon dioxide fertilization whereby the efficiency of photosynthesis rises and the need for water decreases which supports a more dense and lush plant life in any given biome. This causes what has been called the greening of the Earth, which is the increase in the amount of surface area of the leaves of all the plants on the planet. This effect has been occurring for various decades (Zhu et al., 2016). The reason for the increase in atmospheric CO_2 is that the fertilization effect is not linear and, as stated above, this increased plant cover can only be supported by higher levels of atmospheric CO_2. The reason is that at any given time, mature biomes are operating at full capacity, and further plant growth is limited by access to resources. These include water, nutrients, warmth, and sunlight. These can be limited because the environment is harsh or because competition from other plants creates scarcity. An example is the lack of sunlight and available nutrients on the floor of tropical rainforests. Because CO_2 is one of the key plant nutrients, ease of access to CO_2 allows plants to save energy and compensate for the scarcity of other resources, and grow in otherwise marginal environments. Since absorption of CO_2 from the air has an energetic cost for plants, this use of marginal environments is only possible with increased levels of CO_2 because it decreases this energetic cost. For plants to absorb CO_2, the stomata in their leaves need to be open to allow CO_2-bearing air to access chlorophyll. However, water flows in the other direction and this water must be absorbed from the soil and transported to the leaves through a series of steps which require energy.

The balance in the energy that flows out of the plant through water vapor loss and that which is captured by the plant as a consequence of the absorption of CO_2 is an important factor determining whether a plant can grow or not. A plant that uses all its energy to maintain its basic metabolism will not have enough leftover energy to sustain cell division and deposition of cellulose needed for growth. An interesting example of this is the observation that the fronds of coconut palm trees get smaller as the trunk grows taller. When the palm tree is short, the fronds are huge and the trunk wide, but as the trunk grows, the fronds get smaller and the trunk thinner, most likely because they have little energy left over after raising water from the ground to the leaves. It is possible that biochemicals mechanisms in the plant detect the levels of energy surplus in order to control the amount of growth. Consequently, since prediluvian forests were larger than those in the present, judging from the amount of buried biomass in fossil fuel deposits, there is reason to believe that one important factor making this possible was increased levels of atmospheric CO_2. This, in turn, would have created a warmer prediluvian climate, which would have allowed dense forests at higher altitudes and latitudes than we see today.

C-14 is created at a uniform rate by the bombardment of nitrogen atoms by cosmic rays, and it also decays at a uniform rate. As a result, the total amount of carbon 14 tends towards a steady state. At this steady state, one would achieve a stable maximum total amount of C-14 for the planet. However, the concentration of C-14 varies depending on the total amount of carbon contained in whatever carbon sink is in dynamic exchange with the atmospheric source of C-14. If this total amount of radiocarbon is diluted into a greater sink of carbon, then the concentration of C-14 will be much lower, even though the total amount would be the same. This means that the total amount of C-14 in any given animal or person would also be lower, presumably leading to a lower mutation rate and slower aging. Since the half-life of C-14 is 5,730 years, it would take several half-lives to reach this maximum equilibrium, so the actual amount of prediluvian radiocarbon would depend on the amount that existed at the point when God created Adam. However, it is reasonable to assume that God would not have created more radiocarbon than what would exist after reaching a steady state. Consequently, for purposes of analysis, we will use the steady-state amount as a maximum amount of total radiocarbon on the planet.

In 1974, the United States Geological Survey conducted a comprehensive national assessment of U.S. coal resources and broke them down by certainty of existence and recoverability. They also published a similar estimate for the world. They estimated that there are 16 trillion short tons (1 short ton = 2,000 pounds, 1 metric ton = 2204.6 pounds) of coal in the world, 4.4 trillion of these being in North America, 3.9 trillion in the United States (Averitt, 1974). This amount is a hypothetical estimate and represents a maximum. The same study determined that identified resources amounted to 6.4 trillion short tons worldwide, 1.9 trillion in North America, and 1.7 trillion in the USA. Identified resources are those that are extrapolated from measurements taken at approximately two-mile intervals. These measurements are exact measurements using drill holes, outcroppings and other types of precise observations. As a note for comparison, only 1.16 trillion short tons are deemed commercially recoverable (EIA, 2022). A similar analysis by BP (British Petroleum) produced an estimate of 1.06 trillion metric tons (BP, 2019). The important number here is the total amount of buried coal, since that is the amount that represents the carbon contained in the prediluvian forests which were buried during the great Flood. I could not find a more current estimate of total planetary coal, and I do not have the expertise to produce a more accurate estimate, so I believe it is reasonable to use the number determined by the USGS. In any case, that total number should be significantly higher than the identified coal.

Coal is not pure carbon, but can range from a 98% carbon content in super anthracite to about 25% in lignite. A recent estimate categorized proven reserves at 753 billion metric tons of anthracite and bituminous coal and 320 billion metric tons as sub-bituminous and lignite (Energy Institute, 2023). The first category has approximately 80% carbon content, and the second about 40% carbon content. This would give the average amount of carbon in a given mass of coal as 68% by weight ((753 × 0.8) +(320 × 0.4))/(753+320). Notice that the USGS uses short tons while the rest of the world uses metric tons. If one takes this ratio as characteristic of total planetary coal, this gives us 10,880 gigatons of carbon equivalent (10,880 GtC). The amount of carbon in oil reserves is much smaller. Proven recoverable oil reserves are about 1.73 trillion barrels. A barrel of oil has 127.6 kg of carbon. This represents 221 GtC (metric tons). Natural gas reserves represent even less carbon. There exists 196 trillion cubic meters of natural gas, which represents 100 GtC (BP, 2019). I could not find an estimate for unrecoverable oil or natural gas. I get the impression that most oil and natural gas is considered theoretically recoverable. Adding these numbers together gives an estimate of about 11,000 GtC in the form of fossil fuel deposits on the Earth. My impression is that the 10,880 GtC for coal is too high and the estimates for oil and gas are too low, but these errors tend to cancel out, so a good estimate would possibly be 7,000 to 10,000 GtC buried in fossil form. Of course, it is also possible that current estimates are too low and that future technology will allow us to discover fossil carbon which is currently inaccessible.

In addition to the buried carbon, which is isolated from sources of C-14, there exist carbon reservoirs that are in equilibrium with atmospheric C-14 and act as a sink to dilute newly created C-14. Some of these sinks are in fast equilibrium, and some are in slow equilibrium. The carbon sink in the fastest equilibrium is atmospheric CO_2, followed by plants. The ocean surface tends to show an age of about 400 years by carbon-14 dating. There is some variability in the estimates for the exact amount of CO_2 in the atmosphere. One way to calculate it is by using the total mass of the atmosphere and the concentration of CO_2. Depending on the exact values used, one gets 898 GtC. (5,140,000 GtC air × $422{\times}10^{-6}$ CO_2/air/28.97 gm mole air × 12 gm mole C-12.) $5.14{\times}10^6$ GtC is the mass of Earth's dry air; humid air is less dense, but the difference is less than 1%. Therefore, we estimate the amount of carbon which is currently in rapid equilibrium with the atmosphere to be about 2200 GtC. We arrive at this number by adding 898 GtC as CO_2 in the atmosphere, 610 GtC in living plants, and 670 GtC in the upper ocean (898 + 610 + 670 = 2178). The amount might be less because much of the carbon in the ocean surface is in the form of carbonate and might be in a slower equilibrium.

There is a further 1600 GtC in soil and 36,730 GtC in the deep ocean, but these are in a slower equilibrium with the atmospheric C-14. Part of the intermediate ocean (around 1500m) shows a radiocarbon date of up to 2400 years, which is two-fifths of a radiocarbon half-life (Matsumoto, 2007). The age is greater in the Pacific Ocean than in the Atlantic. This means the Pacific Ocean has a lower C-14 concentration than the Atlantic. Deeper water has a radiocarbon age of up to 6000 years (Repeta Group). This is assuming a steady state of C-14 concentration. However, this age puts it before the accepted date for the Flood, so one would have to consider possible lower levels of C-14 at that time, which might make the real age smaller. However, this means that even though the deep ocean participates as a sink for carbon-14, the fast sink is more important, even though it contains less carbon. If this were not the case, then the burning of fossil fuels would barely make a dent in atmospheric CO_2 levels.

Important Carbon Reservoirs

Since the middle of the last century, carbon dioxide levels in the atmosphere have risen by 50% from 280 ppm to 422 ppm and there has been a greening of the Earth whereby there has been an increase in the surface areas of all leaves on all plants by about 5% in the last 20 years (Chen, Myneni, et al., 2019) (Table I). This is associated with a corresponding increase in plant mass, although it is not clear how much of an increase in plant mass this represents. It represents at least a 5% increase, but may be more because this assumes only an increase in leaf area. This increase in leaf area can take two forms: more plants or larger plants. For a plant to increase its leaf area by a certain fraction, it would have to increase its size in all dimensions. However, the leaf area increases by the square of the increase in size, while the volume and total mass increase by the cube of that fraction. Therefore, a plant which increased its leaf area by 5% would need to increase its mass by 7.6% ($1.05^{3/2}$). Furthermore, larger organisms are stockier because the strength of branches (or bones) is a factor of the cross-sectional area (compare a horse to an elephant).

If we use the estimated size of the smaller preindustrial carbon sinks and compare that to the likely size of the prediluvian sink, we can get an estimate of the fraction of C-14 in the prediluvian biosphere. A possible estimate for the preindustrial carbon

Table I. Important Carbon Reservoirs

Total Hypothetical Coal	10,880 GtC	(16,000 Gt coal)
Identified Coal Resources	4,352 GtC	(6,400 Gt coal)
Commercially Recoverable Coal	789 GtC	(1,160 Gt coal)
Oil	221 GtC	(1,730 Giga barrels)
Natural Gas	100 GtC	(196 Trillion M3)
Total Fossil Carbon	7,000 to 10,000 GtC	
Fuel Already Burned	440 GtC	
Atmosphere	898 GtC	591 GtC
Soil	1600 GtC	2003 GtC
Plants	610 GtC	876 GtC
Peat	250 GtC	
Ocean Surface	670 GtC	621 GtC
Deep Ocean	36,730 GtC	37,812 GtC
Saprosphere (Marine Organics)		1396 GtC
Total Carbon on Earth Surface	650,000,000 GtC (including carbonate minerals)	

Sources: (Damon and Sternberg, 1989; Berger and Anderson; Zeebe and Dieter, 2001; Green and Byrne, 2004; EIA, 2022) sink is 599 GtC (atmosphere, 2/3 of present) + 580 GtC (plants, 95% of present) + 670 GtC (ocean surface, same as present) = 1849 GtC. If we assume that the prediluvian carbon sink was that amount plus the amount of fossil fuel in the ground and the amount already burned (see below), then the total is 1849 GtC + 10,000 GtC + 440 GtC = 12,289 GtC. 1849/12289 is 0.150. This means that, assuming a known amount of fossil fuels, and adding carbon in the upper oceans and in the atmosphere, the prediluvian sink was about seven times larger than the present, and the C-14 concentration would have been at most about one seventh that of the present. It is likely that the surface ocean sink has also increased since the last century due to absorption from the burning of fossil fuels, but that value is not certain. If we assume it has risen by 50%, just like the concentration of CO_2 in the air above the ocean, then the preindustrial carbon sink would be 599 + 580 + 426 = 1605 and the pre-to-post-Flood ratio would be 0.131, which is a little more than one eighth. The reason we should not use the present ratios is that, along with the increase in atmospheric CO_2, there has been a large increase in C-14 from hydrogen bomb testing in 1961 and 1962. This changes the baseline for cancer and longevity in the recent past. We will discuss this later.

If the carbon sink before the Flood was eight times larger than at present, this means that C-14 ratios in living creatures would have been about one-eighth what they are now. This represents a maximum, since it assumes that the amount of C-14 was already at equilibrium levels. Furthermore, it is possible that to sustain such a large biomass, atmospheric CO_2 levels were much higher, greatly increasing the total carbon sink. It is possible that the oceans were shallower so that some of the CO_2 currently trapped in the lower ocean was in the atmosphere. Current CO_2 levels as of October 2023 are 422 ppm in the atmosphere. Indoor levels in residential and commercial spaces can often reach 1000 ppm. 5000 ppm is considered safe, and 10,000 ppm is considered safe for up to 8 hours in the workplace. Exhaled air contains 40,000 ppm, so such a level would lead to shortness of breath (MNDH). That level would be an absolute maximum level for the survival of animals.

Plants grown in greenhouses are sometimes given supplemental CO_2. This supplementation causes increased yields, especially in flowering plants. According to the Oklahoma State University Extension, the optimum CO_2 level is around 1200 ppm, at which point plant yields are about 2.5 times those in ambient CO_2, but the curve is relatively flat between 1000 to 1400 ppm, so it could even be higher. The latter number is about 5 times the pre-industrial level of CO_2 and more than 3 times the current levels. It is interesting that temperature can affect plant growth by affecting the rate of photosynthesis. At ambient CO_2 levels, the ideal temperature for plant growth is about 77°F (25°C), while at increased CO_2 levels, the ideal temperature is about 100°F (37°C). At that temperature and CO_2 concentration, photosynthesis becomes 3.5 times more efficient (Dunn and Poudel, 2023).

Amount of Radiocarbon in Coal

It is significant that radiocarbon dating of coal deposits and other carbon-containing fossils consistently gives an age centered around 40,000 years before present, assuming the current steady state of C-14 (Baumgardner, 2005; Snelling, 2008). Since the half-life of C-14 is 5730 years, this gives an age of almost exactly seven half-lives. This represents a concentration of 0.0078 times that of living organisms, or 1/128. This is difficult to explain using a uniformitarian framework, which places most of the deposition of coal at 400 million years ago, which means that coal should have almost no detectable C-14. Two explanations that have been given are contamination and in situ formation of C-14 from the irradiation of trace nitrogen in the coal by radiation given off by small amounts of radioactive isotopes from the uranium-thorium series embedded in the surrounding rocks. However, techniques to avoid contamination have made little difference to the consistent results, and calculations predict that the amount of carbon 14 produced by irradiation is too small (Brown, 1988; Baumgardner, 2005).

It is easier to harmonize the amount of radiocarbon found in coal and fossils with the theory that posits a recent worldwide Flood. According to recent conservative estimates for the date of the Flood (Thomas, 2017), depending on whether one uses the Hebrew or Greek text of the Old Testament, the Flood occurred either 2518 BC (using MT) or 3168 BC (using LXX), while Ussher's traditional chronology, also based on the Masoretic Text, places it at 2348 BC. Either way, that is about one C-14 half-life from the present. The calculations above for the prediluvian carbon sink would account for an apparent three more half-lives (a dilution by a factor of 8). However, those calculations are for the smallest possible prediluvian carbon sink. It assumes most of the fossil fuel deposits have been found and it does not account for living organisms that put carbon into solid forms of carbonate, such as shells and corals. This leaves three half-lives or another dilution factor of eight to account for. However, if we assume that only half of the fossil fuel deposits have been found, that would account for another dilution by 2, and carbon in marine shells could account for another dilution by 2. This leaves one final half-life or dilution of

2 to account for. This could possibly be accounted for by postulating a decreased formation of C-14 before the Flood, perhaps by a stronger magnetic field. Another possibility is that there could be gaps in the Biblical record. However, it seems that using this method of accounting for the radiocarbon age of fossil fuels puts a limit on how far back the Flood occurred to a maximum of about 11,000 BP, which is about two C-14 half-lives before present (5370 × 2 = 10,740). This, of course, assumes that the amount of C-14 already existed at a steady state level, and it is possible that the total amounts were lower.

If one assumes that C-14 decay is the main factor limiting maximum longevity, it would be reasonable to assume that the acquisition of a deadly cancer, on average, occurs after a certain number of C-14 decays occur in the body. This assumption is based on the 'multiple hit' theory of cancer. This theory posits that a single cell needs to undergo several specific mutations that disable certain specific cancer-preventing genes. Since there are a great number of cells in the body, the probability of undergoing these mutations is mainly a factor of the number of total mutations that occur in all the cells in the body. After a given number of mutation events, the probability that the right combination of mutations that produce cancer will occur in at least one cell becomes one. This means that there should be a nearly linear relationship between the rate of exposure to decay events and the time to acquisition of deadly cancer. This would imply a fairly linear relationship between the amount of C-14 in the body and longevity, for example, halving the amount or concentration of C-14 would double the life-span because it would take twice as long to achieve the amount of mutations necessary to produce deadly cancer. We will discuss this later.

The oldest prediluvian person in the Biblical record lived 969 years, which is about 13 times that of the average current lifespan for the world (969/73=13.3). However, 35 countries have a life expectancy higher than 80 years, and in those countries, about one quarter of the population reaches 90. If we use that as the highest typical modern lifespan, it means that prediluvian patriarchs lived about 11 times longer (969/90=10.7) If we accept for the sake of argument that there is a fairly linear relation between amount of radiocarbon and time to deadly cancer, this means the concentration of C-14 was about 1/11 the present concentration. Extrapolating from current carbon sinks and fossil fuel stores, we can explain a dilution to about 1/8. However, the difference can be easily explained by the factors given above concerning the low levels of C-14 in coal and serves as another line of evidence to support the idea that C-14 levels before the Flood were between 1/11 to 1/64 times that of the present.

Radiocarbon and Carbon Dioxide Equilibrium

There seems to be a measure of variability in the estimates of production of C-14. One accepted estimate of the current rate of production of radiocarbon is 2.245 C-14 atoms/s/cm^2, based on the averages of the production during solar maxima and minima (Damon and Sternberg, 1989). That would be the equivalent of about 3.61×10^{26} atoms per year (2.245 C-14 atoms/s cm^2 × 5.096×10^{18} cm^2/Earth × 3.16×10^7 s/yr), or 8.4 kg. A more recent study found a production of 2.05 C-14 atoms/s/cm^2 (Masarik and Beer, 2009). An even more recent study based on empirical measurements has placed that estimate much lower, at about 2.2×10^{26} atoms per year (Kanu et al., 2016), which is 1.37 atoms/s/cm^2 and 5.1 kg. The amount of radiocarbon that decays every year is 0.00012 of the total stock. If production and decay are in equilibrium, this would put the total stock of carbon 14 on Earth at about 42 to 70 metric tons. However, the total amount of radiocarbon believed to be in the atmosphere is about 750 kg. Consequently, this would put the total carbon stock, which is in equilibrium with the atmosphere, at 42 to 70 trillion tons of carbon (42,000 to 70,000 GtC). That is about the amount of carbon found in both the fast equilibrium sink and the slow equilibrium sink, which includes the deep ocean.

However, if atmospheric CO_2 is in equilibrium with both the fast and slow reservoirs, it seems that the burning of fossil fuels should not have caused the levels of atmospheric CO_2 to rise as rapidly as it has. Even if all the carbon emitted into the atmosphere in the last 100 years were absorbed by the deep oceans, it would only increase the CO_2 concentration by about one percent. This seems like an insignificant increase, and one well within the capacity of the deep ocean reservoir to absorb. If atmospheric CO_2 is in equilibrium with the deep ocean carbon sink, then the burning of fossil fuels should have little impact on atmospheric concentration, and the levels before the Flood should also have been about the same as now, because there would have existed a similar sink.

However, this does not seem to be the case. It has been estimated that since the beginning of the industrial revolution in 1750, 440 GtC have been released into the atmosphere. More than 50% of the total has been released since 1990 and about 75% since the early 1960's (Stainforth and Brzezinski, 2020). However, in the same amount of time, levels of CO_2 in the atmosphere rose from 280 ppm to almost 422 ppm now. In 1963, about 60 years ago, it was 318 ppm (Tiseo, 2022). One estimate of the amount of carbon represented by the amount of CO_2 in the atmosphere is 898 GtC at the present, with a concentration of 422 ppm. This means that there were 595 GtC in the atmosphere when the concentration was 280 ppm. That is an increase of 303 GtC. This means that of the 440 GtC released into the atmosphere in the last 100 years or so, 137 GtC have been absorbed into other, non-atmospheric reservoirs. If one assumes, for the sake of visualization, that this reservoir behaves just like the atmosphere, then the total amount in this reservoir, including the atmosphere, would be 1355 GtC (422/137*440 GtC). This seems to be the part of the carbon reservoir that is in about a 50-year equilibrium with the atmosphere.

It is of note that the testing of nuclear weapons in the air starting in July 1945 and ending in October 1963 doubled the concentration of C-14 in the atmosphere for a short time (double pre-industrial levels). Most of the increase occurred after the test of the first hydrogen bomb in March 1954, especially 5 extremely large hydrogen bombs set off by the Soviet Union in 1961 and 1962. It peaked in 1964 and began to drop by about 6.7% per year with an atmospheric half-life of about 10 years until about 2021, at which time levels were back to the pre-industrial baseline. As fossil fuels are burned, the concentration of C-14 drops as expected, so that by the beginning of the bomb spike in the mid-1950's, the concentration of C-14 was already about 20% below preindustrial levels. This indicates several things. Notice that the radiocarbon was not disappearing by radioactive decay because the half-life is much too long. It seems reasonable to assume that it is being absorbed by the same things that absorb CO_2 out of the atmosphere. If one puts a substance into a reservoir, it will disperse until it fills it and then will reach a stable concentration throughout the reservoir. If one knows the amount of substance placed in the reservoir, one could use the final concentration to determine the size of the reservoir. Radiocarbon injected into the atmosphere by nuclear testing spread throughout the atmosphere and reached a uniform atmospheric distribution in about a year. From that reservoir, radiocarbon has been leaking out into other larger reservoirs. So far, the concentration has decreased from about 120% above baseline to at most about 20% above baseline. Using some algebra, we find that the reservoir absorbing the bomb radiocarbon, including the atmosphere, is at least five times that of the atmospheric reservoir. If one uses the amount of carbon in the atmosphere in 1963 as the size of the atmospheric reservoir, that would be 662 GtC for the atmospheric reservoir, which would mean the size of the total reservoir would be about 3310 GtC. That might be an upper limit because as the bomb spike fades away, the diluting effects of the burning of fossil fuels become more significant.

This means that different forms of carbon seem to be in equilibrium with different reservoirs. The smallest reservoir seems to be that which is absorbing the CO_2 produced by the burning of fossil fuels. This reservoir contains about 1355 GtC. The next largest is that which absorbed the bomb radiocarbon spike, containing about 3310 GtC. Finally, the reservoir, which absorbs the cosmogenic radiocarbon, produced by cosmic rays, seems to contain more than 40,000 GtC. If anthropogenic CO_2 were in equilibrium with the deep ocean, then the levels of CO_2 would hardly increase, but that is not the case. It is possible that all the reservoirs may be connected by fluxes which exchange CO_2 in and out of the reservoir. There is a sink in rapid equilibrium that absorbed the bomb radiocarbon, which is about 3310 GtC. This is a little larger than the sink, which includes the atmosphere, the living plants, and the upper oceans. This means there exists approximately another 1300 GtC which might include the carbonate fixating of marine life, such as corals and shell-producing molluscs, and soil turnover. The slowest and largest reservoir would be the lower ocean, which is capable of exchanging CO_2 over a period of many hundreds of years, and is in a longer-term equilibrium with the cosmogenic radiocarbon. These are reservoirs that exchange radiocarbon (C-14) for stable carbon (C-12). In addition, some research has suggested that some of this radiocarbon is removed by being trapped in organic marine sediments produced as dead creatures fall to the ocean floor.

The reservoir which absorbs androgenic CO_2, which is the CO_2 that is produced by the burning of fossil fuels, is in a separate category from that which absorbed the radiocarbon bomb spike. It is different because this is not a process of exchange, but of absorption. For the androgenic CO_2 to be absorbed into the reservoirs, the reservoirs need to expand. For the reservoir consisting of living organisms, this means that plants have to grow, new land has to become capable of supporting vegetation, and forests need to expand. For this, the soil needs to be conditioned and needs to absorb more carbon from dead organic material. This is a relatively slow process. When CO_2 is absorbed into the upper oceans, it increases the acidity of the oceans, which may put pressure on the ability of the oceans to absorb more CO_2. Furthermore, the rising temperature of the ocean may make it less able to absorb more CO_2. These feedback mechanisms may prevent the deep oceans from absorbing larger quantities of CO_2, at least in the short-term frame. However, it seems that the C-14 is in general equilibrium with two different reservoirs, that is, different from the reservoir which absorbs CO_2. A fast one, that absorbs spikes of C-14 using a process of exchange, where a C-14 atom is absorbed but a C-12 atom is returned to the atmosphere, and a slower one which is in equilibrium with the larger deep-ocean reservoir; perhaps because the longer half-life is associated with this longer time frame.

Nevertheless, it seems odd that there is this large difference between the very large reservoir absorbing naturally produced C-14 and the much smaller one absorbing anthropogenic CO_2. Other possibilities are that our measurements of the formation of C-14 in the atmosphere are overestimated or that C-14 is actually not in equilibrium. If the concentration of C-14 before the Flood was actually less than it is today, then C-14 would not be in equilibrium because it takes several half-lives to get to equilibrium, and only one half-life has occurred. We can calculate how close we are to equilibrium starting with the observation that $dx/dt=R-x*\ln2/t_{1/2}$ and deriving from that the formula $X_t=C(1-e^{-t/t1/2})$, (where $C=R*t_{1/2}/\ln2$, R = rate of production and $t_{1/2}$ = half-life). To find how close we are to equilibrium, we can use $E_t = X_t/X_0 = 1-e^{-t/t1/2}$. If the levels of C-14 at the Flood were almost zero, we would be at 63% of equilibrium after one half-life. However, it seems that C-14 levels have been stable for several thousand years, which argues towards equilibrium. I lean towards the explanation in the previous paragraph, perhaps combined with the possibility that the measurements of C-14 formation are overestimating the quantity being produced. C-14 is in equilibrium with different reservoirs. The fluxes into some reservoirs are faster than others. At present, the fast reservoirs are so small that the equilibrium with the large deep ocean reservoir predominates. However, as the fast reservoir expands by the introduction of anthropogenic CO_2, this causes a dilution of C-14, which is what is being observed.

Radiocarbon Levels After the Flood

If we assume that the cancer incidence rate is somewhat linearly related to the cancer-producing stimulus and we assume C-14 to be a large part of that stimulus, then we should assume that C-14 levels before the Flood were at most about one eleventh of the current levels. This is the ratio that we get by dividing the age of Methuselah by 90, the life expectancy of the top quartile of the people in the healthiest countries at present. The evidence from the levels of carbon 14 in coal would argue for even lower levels. We could use either starting point to calculate how the concentration rose after the Flood, assuming that the rate of production was close to what it is at present.

Immediately after the Flood, levels of CO_2 in the atmosphere would have been the same or higher than before the Flood. As organic matter decayed, these levels may have actually increased. Also, it seems that extensive volcanism may have occurred during the Flood, spewing out large amounts of CO_2 into the immediate post-diluvian atmosphere. This could have lasted from a number of years to even centuries after the Flood and during this time, radiocarbon concentrations would have remained about the same or even decreased. However, as plants and trees began to grow, they would have started to absorb much of the CO_2 in the atmosphere, lowering it to current levels over a period of decades to centuries. The amount of carbon currently in the biosphere is comparable to the mass of carbon currently in the atmosphere. If one assumes that most of that carbon was drawn out of the early post-diluvial atmosphere, that means the CO_2 concentration was at least double the present. If one also includes some of the carbon in soil and peat, that could represent a tripling of CO_2 concentration immediately after the Flood, compared to the present, which we saw was the ideal level for plant growth.

According to Genesis 7:6, Noah was 600 years old when the Flood came. It is not clear to me what the significance of this round number is. Nevertheless, Noah died when he was 950, which makes him the third-longest-lived human recorded in Genesis. He lived 350 years after the Flood. His longevity might be due to the initial protective effects of increased CO_2 levels and lower radiocarbon levels immediately after the Flood. Perhaps these increased CO_2 levels may have caused Noah's grape vines to produce grapes with higher sugar levels than he was used to, leading to a higher alcohol level than he was used to and causing him to become unexpectedly drunk (Dillow, 1982). Lower atmospheric pressure could have also contributed. It is interesting that the narrative never condemns Noah for getting drunk. This suggests the possibility that Noah was unaware of the intoxicating effect of what he was consuming, and may have led him to be more betrayed by his son taking advantage of something over which he had no control because of his lack of previous experience.

According to the Hebrew Masoretic Text (the one used in most translations of the Old Testament), the next four generations see a gradual decrease in lifespan. Shem, Noah's son, lived 600 years, but the next three generations lived to their mid-400's. Arphaxad lived 438, Shelah lived 433, and Eber lived a little longer at 464. Shem was born before the Flood and was 98 years old at the time of the Flood. He begat Arphaxad two years after the Flood at the age of 100. After the birth of Arphaxad, the Masoretic Text reports that the age of procreation suddenly drops from around 100 to mid-30's and the total lifespan drops to the mid-400's. This sudden drop in age at procreation is difficult to explain. Furthermore, after Eber, the lifespan suddenly drops again by almost half. According to this genealogy, Shem outlived all of his descendants all the way to Abraham. In fact, much of the Jewish Chazalic literature, particularly Targum Jonathan, Targum Yerushalmi, and the Babylonian Talmud, identify Melchizedek with Shem. Jerome says that this was the prevailing opinion of the Jews at the time (McClintock and Strong, 1880). However, these sudden decreases in age at procreation and in longevity seem difficult to explain. In fact, it might even suggest that there is a gap in the genealogy between Eber and Peleg.

However, there is an important textual variant here. The Septuagint, an ancient Greek translation of the Old Testament, adds a hundred years to the age at procreation. Some Christian teachers and writers tend to have a low view of the Septuagint in comparison to the Hebrew Massoretic Text because the former is a translation and, especially in the latter portions towards the end of the Old Testament, not a very good one. However, the Pentateuch of the Septuagint, the first five books, was translated before the other parts of the Septuagint and is of higher quality. It was most likely translated about 280 to 250 BC in Egypt, so it represents a very ancient witness to the text of the Pentateuch (Durham, 2019). The Septuagint was the Bible of the early Christian Church and is the most quoted version in the New Testament. This gives it a measure of divine recognition. Furthermore, the oldest existing complete manuscripts of the Old Testament are copies of the Septuagint. Complete manuscripts of the Hebrew Text are from a much later date. The Samaritan Pentateuch, another ancient text, agrees quite closely in the post-diluvian chronology with the Septuagint, and so does Josephus, the famous first-century Jewish historian. However, it must also be noted that the Septuagint also adds one hundred years to the date of procreation of the prediluvian patriarchs. However, here the Samaritan Pentateuch agrees with the Hebrew Masoretic Text before the Flood. Furthermore, an extra patriarch, Cainan, is inserted, but the ages are the same as for Salah, and he does not appear anywhere else in Scripture. It may have been another name for Salah, which made its way into the Greek text as a duplication (Douma, 2017).

A variant of this significance demands a possible explanation. It seems too extensive and complex to have simply occurred as a scribal error. One possibility is that the variant is the result of the fierce polemic between the Jews and the early Christians, especially after the failed Bar Kokhba revolt, which was crushed in 135 AD and led to a permanent separation between Jewish Christians and Rabbinical Judaism (which was evolving from the sect of the Pharisees). The earliest literature to equate Melchizedek with Shem is the Seder Olam Rabbah, a Hebrew language chronology created around the year 160 AD. Before this time, Jewish literature considered Melchizedek to be some type of angelic being. A case has been made that the publication of this chronology coincided with editorial changes in the Masoretic Text which reduced the ages of the post Noahic patriarchs in order to discredit the early Christian teaching that Jesus was a priest according to the order of Melchizedek. The book of Hebrews makes the case that the Melchizedekian priesthood was distinct from and superior to, the Aaronic priesthood. However, if Melchizedek was Shem, then his priesthood would have been transferred to Abraham, and then to Aaron, equating the Melchizedekian priesthood with the Aaronic priesthood (Rudd, 2017). In that case, as the writer of Hebrews points out, since a descendant of David has no rights to the Aaronic priesthood, this would then mean that Jesus could not play the role of God's righteous priest.

Compared to the Masoretic Text, the Septuagint/Samaritan chronology has a more gradual decrease in ages and in age at procreation from Arphaxad to Abraham. It is noteworthy that this is the age at procreation for males. It is very possible that the age at procreation for females dropped faster, so that Sarah giving birth at 90 years of age was exceptional. The list is as follows, with Cainan removed (Table II).

Table II

Name	Son LXX	Total LXX	Son MT	Total MT
Arphaxad	135	565	35	438
Salah	130	460	30	433
Eber	134	504	34	464
Peleg	130	339	30	239
Reu	132	339	32	239
Serug	130	330	30	230
Nahor	79	208	29	148
Terah	130	275	130	205
Abraham	100	175	100	175
Totals	970		450	

After the Flood, conditions were conducive for the growth of vegetation. We see that in the successful cultivation of grapes by Noah. It is likely that vegetation began to grow rapidly after the Flood. This growth of vegetation would have trapped large quantities of carbon in living tissue, but especially in soil. Plants reproduce at a much faster rate than the animals that consume them, so without the natural limits imposed by herbivore consumption, vegetation would have grown unhindered, absorbing large quantities of carbon from the atmosphere. This would have caused the levels of atmospheric CO_2 to decrease significantly. In the near past, before the large-scale burning of fossil fuels, a near steady-state level of CO_2 was maintained by the return of CO_2 to the air by means of decomposition and consumption by animals. Consequently, before the Industrial Revolution, carbon fluxes into and out of the atmosphere were balanced. However, shortly after the Flood, the creation of new ecosystems on newly deposited sediments would have caused a net carbon flux out of the atmosphere. There are several lines of evidence that levels of CO_2 dropped to extremely low levels during this time.

First, lowering of atmospheric CO_2 levels would have caused a decreased greenhouse effect and cooling of the Earth. NASA models have shown that if all the CO_2 in the atmosphere were removed, after 50 years, the average temperature at the surface of the Earth would be -21° C (Lacis et al., 2010). Several studies have shown that C3 plants have difficulty surviving once the CO_2 concentration reaches 100 to 150 ppm (Dippery et al., 1995) (Campbell et al., 2005), so that would seem to be a lower number for the ability of plants to extract CO_2 from the atmosphere. Such levels are a third to a fourth of the current levels and would likely be associated with significantly lower temperatures. This drop in CO_2 levels, coupled with warm oceans after the Flood, may have been the cause of the post-diluvian Ice Age. The oceans are believed to have been warm because the fountains of the deep were probably hot subterranean eruptions of water

A second line of evidence which supports low CO_2 levels after the Flood is the lack of dense forests during the Ice Age, even in relatively warm areas. Instead, grasslands and savannas were prevalent (Dherbert, 2019). I believe it is significant that all large trees are C3 plants. That is, they use the C3 metabolic pathway for carbon fixation using photosynthesis. C3 plants are more sensitive to CO2 concentration and water availability. C4 plants are more robust in the presence of low CO_2, low humidity, and heat. Many grasses are C4 plants, while most dicots, including trees, are C3 plants. However, there is a metabolic cost to this robustness, so C3 plants are more energetically efficient in fertile environments. In a low CO_2 environment, it is reasonable that C4 plants, such as grasses, would have outcompeted C3 trees.

Finally, trapped air bubbles in Antarctic ice core samples show fluctuating levels of CO_2 from the lowest layers to the present. The lower layers, which represent the early Ice Age, have levels which fluctuate between 170 to 260 ppm. These levels were found in cores taken between 3050 to 3190 m in depth (Luthi et al, 2008). These levels are about one-half current levels. Since the production of radiocarbon is relatively constant, this would have caused a faster increase in the concentration of radiocarbon per mass of CO_2, since it is being absorbed by a smaller sink.

This hypothesis tries to explain a problem that has been hard to explain, the origin of the ice ages. However, one must now find an explanation for the end of the Ice Age. A detailed discussion of this topic is beyond the scope of this paper, but I would suggest three possibilities, likely in combination. First, elevated levels of volcanic activity could have raised the level of CO_2 in the atmosphere. Currently, volcanoes contribute about 0.2 Gt CO_2 per year to the atmosphere (Yue, 2018). After the Flood, it may have been much more. Secondly, the proliferation of herbivores may have culled the savannas and returned CO_2 to the atmosphere, allowing the growth of trees, which are more difficult for herbivores to access. Herbivores tend to reproduce faster than predators, so it probably took some time for predators to cull the herbivore population. This would allow herbivores time to consume the overgrowth of grasses before they themselves were culled. Finally, organic debris from the Flood, which was lying on the ocean floor or buried in upper levels of land sediments, may have gradually decomposed, returning significant amounts of CO_2 to the atmosphere.

The rate of radiocarbon production was probably comparable before and after the Flood, unless there was a large, sudden decrease in the Earth's magnetic field. What would have changed the most was the size of the carbon reservoirs into which it diffused. If radiocarbon remains contained in the atmosphere and does not diffuse out, its level would rise to current levels within a hundred years, even if the starting concentration were virtually zero. However, we saw that bomb radiocarbon diffused out of the atmosphere with a half-life of about 10 years. In that case, the steady state mass in the atmosphere, when atmospheric concentration is not in equilibrium with downstream reservoirs, would be about twice what is created in one of those half-lives (of 10 years). If we use the value of production of 7.5 kg of radiocarbon per year, then after about seven half-lives, that is, 70 years, there would be 150 kg in the atmosphere.

This is in addition to the prediluvian concentration. This means that by 70 years after the Flood, radiocarbon concentration in the atmosphere would be about 20% of current values, not counting prediluvian radiocarbon. It would likely remain at this level until other reservoirs in slower equilibrium with the atmosphere became filled. This may be why it seems that after Shem, the age stabilized for several generations before starting to gradually decrease again. Selah lived 460 years, which is about 6.5 times the common pre-industrial lifespan of about 70 years. If there is any linearity to the relationship between life expectancy and longevity, then one could postulate that the radiocarbon concentration would be about 1/6.5 times the present, which is about 15% of current levels. This is in general agreement with the estimate of 20% achieved above.

By the time of Abraham, who was born almost a thousand years after the Flood, according to the Septuagint, lifespans had decreased to one-fifth that of Noah and about 2.5 times the common pre-industrial lifespan of about 70 years. If we apply the same assumptions of linearity we used above, then one could postulate that the radiocarbon concentration would be about 1/2.5 times the present, which is about 40% current levels. Since a thousand years is much less than the half-life of radiocarbon, one can assume that the concentration of radiocarbon in a more global reservoir was increasing linearly with radiocarbon production. One can then estimate the size of this carbon reservoir. By this time, 750 kg of radiocarbon would be produced. That is the amount currently in the atmosphere, but because the concentration was 0.4 times that of the present, it represents a reservoir of carbon 2.5 times that of the preindustrial atmosphere, which would be about 2.5x583 GtC = 1456 GtC. This is close to the value of 1320 GtC, which we estimated to be the functional reservoir absorbing the CO_2 produced by burning fossil fuels.

Consequently, there seems to be a reasonable agreement between rational assumptions about the concentration and effects of radiocarbon after the Flood and the decreasing ages reported in Genesis, at least those found in the text of the Septuagint. How radiocarbon levels reached current levels and then stabilized in less than one half-life probably depends on fluxes between reservoirs, which do not seem to be clearly understood. That would be a topic for further research. However, it seems that we can explain how radiocarbon levels would have risen after the Flood, and they seem to be in fairly good agreement with the decrease in ages found in the book of Genesis.

Mutations and Radiation

This next part of the paper discusses the evidence that radiocarbon is, indeed, one of the most important determinants of longevity. Humans are constantly bombarded by ionizing radiation. The source of this radiation varies by location and by a person's health. The United States EPA has estimated that in the USA, about half of the total radiation received during a lifetime comes from medical tests and interventions, particularly computed tomography imaging (CT scans) which account for 24% of the average person's total lifetime radiation. The main environmental source of radiation is radon exposure, which accounts for 37% of our total exposure. Cosmic radiation accounts for 5%, and internal sources of radiation also account for 5% (EPA, 2022). However, the state of New Jersey calculated the exposure differently. It decreased the amount of medical radiation, putting it at around 15%. This raises radon to 55%, places internal radiation at 11%, external radiation at 8%, and calculates cosmic radiation at 8% (Appleby et al., 1996).

Radon constitutes one of the largest sources of radiation exposure. Radon, a radioactive gas, is a product of the decay of radioactive uranium and thorium in rocks and sand, and it is the second leading cause of lung cancer. It seeps into homes and buildings through microfractures in the foundation and accumulates in the internal air. Radon has a half-life of less than 4 days, so it is constantly emitting radiation in the form of alpha particles. Alpha particles are much larger than other forms of radiation, so they can only penetrate superficial lung tissue. When it is breathed into the lungs, the radiation it emits can cause damage to the DNA of lung cells and can cause cancer-inducing mutations. However, the decay product is solid, and these daughter atoms settle on the lung tissue where they can be absorbed into the body and participate in several further decay steps. In its process of decaying into lead, the resultant atoms emit four alpha particles and four beta particles. The latter, which are energetic electrons, can penetrate tissue more effectively than the much larger alpha particles.

Studies have shown that the cancers caused by radiation are different than the majority of cancers. Radiation-caused cancers most frequently involve two cuts close together in the DNA strand, which result either in the intervening section being deleted or the intervening section being inverted (that is, temporarily excised, then reinserted backwards). (Behjati et al., 2016)

There seem to be two ways in which a high-energy particle can cause a mutation. First of all, it can directly hit part of the DNA strand and either shatter it or ionize it, causing it to react chemically in a way that breaks the strand. Furthermore, the track of the particle through the nucleus will leave a wake of free radicals and other ionized molecules which can bind to the DNA and cause it to be altered chemically leading to a break in the strand. Therefore, the DNA does not need to receive a direct hit, but the closer the particle passes, the greater the chance that it will disrupt the DNA strand.

However, most cancers involve a different mechanism, that of a point mutation in certain specific genes which are involved in suppressing cancer by controlling growth or repairing DNA. These mutations are changes in a single nucleotide that result in a change in a single amino acid in the protein encoded by that particular gene. The most common gene involved in cancer is the TP53 gene, which has several functions in the response of the cell to DNA damage. Depending on the type of cancer, from 10% to 100% of tumors have a mutation in this gene. Most cancers have mutations in several key genes whose function is to prevent cancer. By damaging these cancer-preventing genes, it is more likely that a cell will become cancerous. A mutation in just one gene predisposes the cell to cancer, but does not by itself produce cancer. The cell usually needs a mutation in several genes in order to become cancerous.

The most widely accepted hypothesis of low-level radiation risk is called the Linear-no-threshold (LNT) model. It postulates that radiation is a risk for cancer even at low levels. It has been shown that there is a nearly linear relationship between radiation dose and the increase in certain types of cancer (Ali et al., 2020; Hauptmann et al., 2020). However, studies of low-level radiation, such as that received by means of medical imaging, suggest that at these low levels, cancer caused by single point mutation predominates (Shah et al., 2012). However, it is not clear how this type of dose relates to carcinogenesis, compared to higher levels, because the effect is so small. It is possible that this single-point damage to the DNA strand is easier to repair than the two-point damage caused by higher levels of radiation. Therefore, it is not clear that the dose is linear all the way from low levels to higher levels. In other words, the incidence of cancer may have a linear relationship to dose at low levels and higher levels, but there may be a non-linear inflection in between at the point where the two-hit mechanism of higher doses gives way to the single-hit mechanism, which predominates at lower doses. To be more clear, it is possible that the cell is able to more easily fix the kind of damage to DNA that occurs at low doses, while a higher dose may produce damage, such as double hits, which is more difficult to repair. Furthermore, populations living at higher elevations have shown adaptation to higher levels of low dose radiation (Mortazavi and Mozdarani, 2013).

In contrast to radon gas, which is found outside our body, there are two radioactive chemicals that are found inside our body and are the principal sources of internal radiation. There are also a few others that are found in much smaller amounts. For a 70-kg adult, radioactive potassium (K-40) produces about 4000 Bq [bequerels] of radiation while C-14 produces 3700 Bq of radiation. A Bq is one radioactive decay per second. Both radio-nuclides decay by producing beta particles, which are energetic electrons. However, the energy of the decay of K-40 has about ten times the energy of a C-14 decay, so the contribution to background radiation by C-14 is actually minimal. Nevertheless, its contribution to carcinogenesis might actually be very significant. Potassium resides in the liquid cytoplasm as part of a salt ion. For radiation from radon or K-40 to cause a mutation, the radiation must be absorbed by a strand of DNA, and it must be hit by two events which occur close to each other on the same strand. We saw that most radiation-induced damage takes the form of a section of DNA being excised and then either lost or inserted backwards. If it is inserted in the same direction, nothing changes. It seems that if only one cut is produced, the chemical and structural nature of the strand and the repair mechanism is such that it reconnects easily at the point of rupture.

However, C-14 is incorporated directly into DNA. When a C-14 atom in DNA decomposes, even though the energy released may be small, the carbon changes into nitrogen, and this changes the DNA nucleotide into a completely different molecule, causing a type of point mutation which is more difficult to repair. The reason this kind of mutation cannot be repaired is that the decay of C-14 does not simply create a break in the DNA, but also a change from one type of molecule to another because of the transmutation of C-14 to nitrogen. Furthermore, the recoil from the emitted beta particle is probably enough to completely sever both DNA strands at that point. Therefore, the strand breaks and the nucleotide at that break point is changed or left dysfunctional. One way to visualize the difference between the effect of K-40 and C-14 is that the former is like using a large gun to kill a stranger at a distance, and the latter is like putting a small gun against the side of one's own head and pulling the trigger. The significance of this was noted by Isaac Asimov in a paper originally published in 1957. He later included it in a book published in 1963. He said "carbon-14 is much more likely to be responsible for 'spontaneous' cancer and mutations than potassium-40 is" (Asimov, 1963, p. 44). However, he concluded by saying "the situation isn't as serious as you might think…So sleep in comfort!" (Asimov, 1963, p. 44). Furthermore, he concluded, "there is precious little that can be done about it unless someone turns off the cosmic ray, or unless we build underground cities." (Asimov, 1963, pp. 43–44) However, there is, indeed, something else that can be done; we can eat food grown in greenhouses where the carbon dioxide comes from the burning of fossil fuel which is low in radiocarbon.

We can estimate the number of mutations over time caused by C-14. The present-day concentration of C-14 is 1 in 10^{12} carbon atoms, one in a trillion. There are about 2.2×10^{23} base pairs in a typical human being. We reach that number by multiplying the number of cells in a typical human being by the number of base pairs in the genome by two copies per cell (37×1012×3×109×2=2.2×10^{23}). Each base pair has 9 or 10 carbon atoms in the nucleic acid part of the pair (not counting the deoxyribose sugar part). Using the formula for half-lives, we find that for a substance with a half-life of 5730 years (ln(2)/5730), a fraction of 0.0001209 of the original number of atoms will transform every year. From this, we can calculate the number of decays of C-14 atoms in the DNA of the living cells of the typical human being: $2.2\times10^{23}\times0.000121\times10^{-12}\times9 = 2.40\times10^{8}$ decays per year; which is about 7.61 decays every second. This means that the decay of carbon 14 causes the potential of seven mutations per second in the human body.

The gene encoding the tumor suppressor gene p53 is 19,143 base pairs long. However, the resultant protein itself is 393 amino acids long, so the part that actually encodes the protein is 1179 base pairs long (since each amino acid is coded by three base pairs). The gene has 11 exons, which are stretches of DNA that have regulatory functions rather than being used for protein coding (OHSU, 2019).

A quick internet search will show that there are between 30 to 40 trillion cells in the human body. As stated above, a commonly accepted number is about 37×10^{12} cells. This means that there are 75×10^{12} copies of the p53 gene, 1.3×10^{19} carbon atoms in total, and 8.0×10^{17} carbon atoms if one only counts the coding parts of the genes. Of these, 8.0×10^{5} to 1.3×10^{7} are C-14. About 1.2 out of one hundred of these atoms will decay in 100 years. Therefore, among all cells in the body, 9,600 coding base pairs of the gene will be mutated in a long lifespan, and 156,000 total base pairs of the gene itself will be mutated. In addition to this, the whole genome is 3×10^{9} base pairs long, which is about 3×10^{10} carbon atoms in every cell. This means that 3% of every cell has a C-14 atom in its DNA, so that in one hundred years, one out of every 2,757 cells will experience some kind of mutation caused by radiocarbon decay. That does not sound like much, but it means that 1.3 billion cells will experience some type of mutation event caused by C-14 in a lifetime, and about 10 thousand will experience a mutation in p53, one of the most important genes which prevents cancer. Even though it is hard to calculate the exact probability of some random mutation leading to cancer, based on the calculations above, the decay of C-14 does not seem like an insignificant source of cancer and genetic degradation. It is noteworthy that only one cell must become malignant to kill a person. This could be enough to account for the baseline of spontaneous cancer.

Aging

The process of aging is not well understood, but there seem to be two components to aging. One is an environmental factor where different insults to the body cause wear and tear, which leads to aging. We see that in skin that has been exposed to sunlight. With time, it looks drier and more wrinkled than skin in areas usually covered by clothing. As a physician, I can usually tell when a person has smoked or used charcoal to cook (some older people in my area lived in houses that lacked electricity when they were young). Their skin is much more wrinkled, and they look older than their age. In addition, there is a second component, one which seems to be genetic and preprogrammed. It seems that most cells are programmed to divide 40 or 60 times before they die. This is called the Hayflick limit and involves a method by which the cell is able to count the number of times it divides by using the shortening of repeat segments at the ends of chromosomes called telomeres. The replication process is not able to copy the very tip of the chromosome where the telomeres reside, so it becomes shorter with each division. When the telomere disappears, the cell can no longer divide (Bartlett, 2014)

In order for people to live longer, this limit would have to be increased. This limit is set by the enzyme telomerase, which forms the telomeres in gametes, embryonic stem cells, and a few other cells that need to divide constantly. This enzyme sets the original length of the telomeres and, in that way, controls the number of cycles of division a cell can sustain. It would seem that by increasing this limit, aging can be slowed down. However, when this was done in mice, there was an increased incidence of cancer (de Magalhães, 2004).

This suggests that normal, or programmed, aging, which is caused by a decrease in the rate of cell division, is a way that the body protects itself from cancer. It is possible that the mutations that lead to cancer may lie dormant until the replication apparatus is activated. Cancer might arise as the result of not being able to turn replication off once it starts. Therefore, if we stayed young for all our lives, that is, if all our cells continued to replicate at the same rate as in young adulthood, we would never age, but we would die earlier from cancer. This is why hormone replacement, at least in women, increases the risk of various cancers even though it can make women look and feel younger. It is likely that the aging rate is precisely balanced to maximize our lifespan. Aging is like chemotherapy, too much can cause so much damage that it reduces our lifespan, but too little may allow the cancer to survive. This means that the direct effect of reducing C-14 levels might not be to decrease aging, but to decrease the incidence of cancer, which would then give room for genes to adapt in a way that decreases the process of aging, leading gradually to extended lifespans.

The process for reducing aging might involve the selection of genes which control how long cells can continue to replicate, such as telomerase. It seems to me that genes can be grouped into two fundamental categories, somewhat like nouns and verbs. There is one category that controls the development of structures in the body. This includes things like the activation of genes responsible for the retina and the chambers of the heart. It involves aspects of a body's design where tissues and structures are either present or absent. For example, three and a half ventricles do not work; only three or four. Another of many examples is photoreceptors in the retina, which must be in contact with a particular layer of cells on the bottom and a different one above. Any change in the composition of these layers renders the eye blind and are the source of many blinding genetic diseases. These genes control discrete structures or functions and involve switches where something turns on or off. I believe that such genes are not subject to environmental selection because intermediate forms do not work, which means they are much less adapted than the complete forms. Mutations of these genes are often lethal or incapacitating. The nonfunctional intermediate form is a hard barrier that does not allow environmental selection to work. These genes contain information that is qualitative rather than quantitative. One could think of this as being similar to digital information composed of discrete ones and zeroes.

However, a second category of genes controls amount or size of a substance or tissue. The information these genes carry is quantitative and behaves more like analog information. There is a random variability in these control genes. These genes would include those for height, weight, proportions of the face and body, muscle mass, etc. In this case, intermediate forms are better adapted. For example, medium-height people avoid many of the shortcomings of the very tall or the very short. I believe that these genes are predesigned to mutate in order to produce variability in a population. Our immune system is based on such a system of purposeful high mutation rates with controlled selection. A classic example of such highly mutating genes is those that produce the refined antibodies which protect us against disease. Lymphocytes whose antibodies match viral or bacterial proteins are selected compared to lymphocytes with useless antibodies. Then, the genes coding for their antibodies are continuously modified to refine the bonding ability of the antibody to the foreign protein by selecting among the descendants with the most strongly binding antibodies. In this case, intermediate forms work intermediately, and the more optimally refined forms work best. This is the type of microevolution which Darwin actually described; bird beaks which are longer, shorter, thinner, fatter, for example. His great error was applying these observations to the first category of non-selectable genes described previously, which would be necessary for macroevolution to be possible. It is likely that genes which control the length of telomeres would be subject to this second type of controlled variability. Those individuals which have the optimum rate of aging, where youthfulness is balanced with resistance to cancer, will gradually be selected by the environment. Something similar likely happens with skin color, where sensitivity to the production of vitamin D is balanced with resistance to skin cancer. This mechanism is presented as a topic for discussion and further research. In a similar but opposite way, rapid increases in radiocarbon, like the bomb spike, will likely only increase the rate of cancer and would only gradually accelerate aging.

Other Lines of Evidence

Another line of evidence for the harmful effect of increased levels of radiocarbon after the Flood is the disappearance of the megafauna and even the decreasing size of the human skull. The larger the size of an animal, the more times its cells have to divide and the greater the chance that cancer-producing mutations will occur. Large animals, like elephants, have a higher number of copies of cancer-suppressing genes than smaller animals. A group of researchers found that elephants have 20 copies of the cancer suppressing protein p53. The same paper found that mammoths also had multiple copies of this protein, but only about 14 copies rather than 20 (Callaway, 2015). Some mammoths were bigger than the typical elephant.

Genetic analysis of some well-preserved mammoths shows that they were plagued with genetic mutations, although the fact that they belonged to a small population stranded on Wrangle Island, an Arctic island about the size of Crete, may have contributed to the preservation of harmful mutations (Fry, 2020). Recent studies have shown that megafauna extinction does not correlate well with the arrival of humans to North America. Some megafauna went extinct before humans arrived, and others went extinct many centuries later. Among uniformitarian scientists, the current principal contender for the cause of the demise of megafauna is climate change at the end of the Ice Age. However, it seems to be simply a conjecture with limited evidence, so the real reason is still a mystery. Creation scientist Mike Oard thinks that the end of the Ice Age was associated with a period of colder, drier, windier climate and that this led to the end of the wooly mammoth (Oard, 2006). However, even if further study confirms these climatic changes to be true, there are several problems with these changes being the principal cause for the extinction of megafauna in general. First of all, other, fairly large animals, such as camels, horses, and elephants, did not go extinct, and it is not clear why the megafauna did not migrate to a more hospitable climate. Furthermore, megafauna existed in many locations around the planet and not just close to the Arctic. It is not clear that the same climatic changes that may have occurred close to the melting ice sheets would have occurred far away.

Perhaps rising levels of radiocarbon were an important factor, either alone, or in association with stresses caused by concurrent, climatic changes. If environmental carcinogenicity rose quickly these animals may not have had time to adapt as evidenced by smaller number of cancer suppressor genes. Furthermore, studies have shown that this increased protection from cancer comes at the cost of reduced fertility (Gewin, 2013). Perhaps the elephant survived because they were smaller in size and larger in numbers. Apparently, other megafauna in warmer climates adapted by becoming smaller in size (Herbert, 2004). This reduced body mass would decrease their risk of cancer. It is interesting that the mammoth population in Wrangle Island had large variation in size, including a high degree of sexual dimorphism and the presence of dwarf individuals. This may have helped them survive up to about 4000 years before present (Tikhonov, 2003).

Whales have specialized cancer-suppressing genes (Tollis et al., 2019), but they also have the advantage of living in ocean waters, which have about 8% less radiocarbon (a radiocarbon age of about 400 years) (Mangeruda et al., 2006). This may not seem like a big difference now, but it would have given whales more time to adapt to rising radiocarbon levels in the past.

Some studies have suggested that human brains have been decreasing in size starting from about 3000 years ago (which is around 1000 BC) (DeSilva, 2021), although these results have been challenged. Joshua, Moses, and Aaron, who lived around 1500 BC, lived between 110 to 123 years. Psalm 90, attributed to Moses, sets the common lifespan at the time to 70 or 80 years. However, the headers of the Psalms are commonly accepted as later additions. The uncertainty of the time of punishment described (Psalm 90:13) would agree more with a dating of its authorship to the time of the Babylonian exile since, after Israel refused to enter the land, God immediately told Moses that they would wander for forty years (Numbers 13:33). By the time of David, around 1000 BC, people were living 70 years, which was the lifespan of David. The human brain represents about 2% of the mass of the body, but brain cancer accounts for 3% of all cancers in the UK and the incidence of brain cancer has increased 39% since 1990 (CRUK). However, the brain is very metabolically active, accounting for about 20% of all the energy used in the body. Furthermore, neurons in the brain are among the cells that do not reproduce after childhood. If carcinogenicity from radiocarbon is a factor in decreased ages, it is possible that decreases in brain size were a tradeoff for slightly longer lifespans.

It is interesting that both height and obesity are associated with an increased incidence of cancer in humans (Wolin et al., 2010; Brown, 2015). In both cases, there are more cells, more C-14, and a higher metabolism, which is associated with an increased number of cells that are multiplying and dividing. All these things raise the chance for a cancer-causing mutation to occur.

Another interesting line of evidence is the effect of the spike in radiocarbon produced by hydrogen bomb testing in the late 1950s and early 1960s. Eight of the twelve most powerful hydrogen bomb tests were conducted in 1961 and 1962 by the USSR near the Arctic. As stated before, by 1963 the concentration of radiocarbon in the atmosphere reached a maximum level of twice historical levels. The concentration then began decreasing with a half-life of about ten years, so that the majority of the effect occurred between 1961 and early 1980's. The peak was higher and earlier in the northern hemisphere than the southern because of the location of the largest blasts. One would expect some effect of this peak of radiocarbon on the incidence of cancer if radiocarbon were to be a factor.

Indeed, it has been noted that since 1990, the incidence of cancer, including cancer in young people, has increased by about 40%. This is especially true in cancers in people under 50 years of age, those who were young during the radiocarbon spike. They found that people born in 1960 had a higher risk of cancer before 50 than people born in 1950. They attributed this increased risk to early life "exposome." That is, exposure to carcinogenic risk factors early in life. They concluded that "The incidence of many types of early-onset cancer (in those ≤ 50 years of age) has increased in many countries. The reasons for this phenomenon are not entirely clear but likely relate to changes in risk factor exposures in early-life and/or young adulthood from the mid-20th century onwards" (Ugai et al., 2022). They did not mention radiocarbon, but those born in 1960, especially in the northern countries, had some of the highest early life exposure to radiocarbon in history. After the reports of cancers in members of the British royal family, that paper and scholarly reviews of the paper have garnered widespread media attention. As stated before, the incidence of brain, other CNS, and intracranial tumors has increased by 39% in the UK since 1990 (CRUK). This 40% increase in cancer is remarkably close to the increase in exposure to C-14. If the level of radiocarbon had remained at twice the previous level for a long amount of time we would have expected a doubling of the cancer rate, an increase of 100%. However, the concentration began to decrease rapidly. The cumulative exposure for the 30 years following the peak in 1963 would have been about 43% above previous levels. By that time, around 1993, the spike had dwindled to about 10% above baseline, so the effect would be less.

It is interesting that the radiocarbon bomb spike has also coincided with a period of large decline among amphibians, both in the number of individuals and the number of species. The greatest period of this decline appears to be in the 1980s. There is no good explanation for this decline, but it is interesting that it has occurred at a time when radiocarbon was at its highest level. Most frogs around Chernobyl are now very darkly pigmented, which seems to protect against radiation. This means that frogs seem to be sensitive to radiation because such a rapid adaptation would only occur if radiation killed most of those frogs that were lightly pigmented. This darkening in the face of radiation would mean that frogs are highly susceptible to cancer-causing mutations and would correlate with a die-off related to higher levels of radiocarbon. The Chernobyl frogs used increased levels of pigment to protect themselves from external radiation. The specifics of the mechanism that achieves this adaptation rapidly is open to debate. I believe that rapid controlled mutation rates of control genes as described previously provides a divinely designed mechanism. However, the point is that frogs seem to be particularly susceptible to genetic damage from radiation and the die-offs we have witnessed may have been caused by the radiocarbon bomb spike. Pigmentation is not able to protect animals from mutations caused by radiocarbon embedded in their DNA.

The opposite is also an interesting line of evidence. Some longevity researchers have found that certain locations on the planet have unusually high levels of very old people. In particular, five regions have been popularized as areas with apparent high levels of centenarians, and these regions have been named *blue zones*. The five blue zones are Sardinia in Italy, Okinawa in Japan, Nicoya Peninsula in Costa Rica, Icaria (aka, Ikaria) in Greece, and Loma Linda, California. There is controversy as to whether these zones really have exceptional longevity, and also, what is the secret of their longevity. Many attribute their longevity to diet and lifestyle. However, it is interesting that they are all in coastal regions and tend to eat locally grown food. Because they receive winds from the ocean, it is likely that the exchange of CO_2 with the ocean waters causes these winds to have lower levels of radiocarbon. As stated above, oceans have about 8% less radiocarbon because they have a radiocarbon age of close to 400 years. Also, the oceans close to some of these regions are involved in the upwelling of cold deep water, which is even older, representing even lower levels of radiocarbon.

Puerto Rico, where I live, an island in the Caribbean Sea with a population of only a little over 3 million people, representing 0.04% of the world's population, has had one of the one hundred oldest women on record and two of the one hundred oldest men, including the third longest lived man. This is 37 times the world average. An additional three men and three women from the hundred longest living (100 men and 100 women) come from other islands in the Caribbean. The total population of the Caribbean Islands and surrounding islands is 44 million. That is 0.56% of the world population. This number of super-centenarians per population is 8 times the world average. Among the countries included in the Caribbean is Haiti with a population of 11 million, which is one of the poorest countries in the world. Even though the medical system in many of the Caribbean islands is adequate, it is not exceptional, so the reason for this longevity cannot be that the medical care is the best in the world. Also, it's not the diet. At least in Puerto Rico, much of the population, especially the elderly, is overweight, diabetic, and hypertensive. However, the life expectancy of Puerto Rico and six other Caribbean islands surpasses that of the United States. These islands are bathed by a nice breeze which travels many thousands of miles over the Atlantic Ocean and has plenty of time to absorb low radiocarbon CO_2 from the ocean surface. Locally grown food would have lower levels of radiocarbon, and so would fish from the surrounding sea. Those few percentage points of lower radiocarbon may be enough to produce a few extra supercentenarians.

Longevity is the result of many factors that each independently influence the probability of reaching the upper age limit. An advantage in one of those probabilistic factors means that a person can be a little deficient in other factors and still reach super-centenarian age. Lower radiocarbon exposure could be one of those factors that gives people a little push and makes it more likely to reach these advanced ages.

Further Research

The hypothesis that a radiocarbon concentration lower than today is responsible for increased longevity before and shortly after Noah's Flood can actually be tested by experimentation. It is possible to grow food plants in greenhouses using CO_2 derived from fossil fuel, which has much lower concentrations of radiocarbon. Notice that C-14 is not absorbed directly from the air, but rather through food, particularly protein and folate, which are the metabolic precursors of nucleotides. Therefore, adult human subjects could live a normal life and simply eat food low in C-14. Notwithstanding, it would take decades to get measurable results using adult human subjects who volunteer to eat food low in C-14. However, it might be possible to get quicker results with some types of animal models. Albino laboratory rats tend to have high rates of tumor production of various types. These could be used to see whether there is a difference in tumor genesis in groups fed seed grown in normal atmospheric CO_2 and those fed seeds produced inside a greenhouse where fossil fuel-based CO_2 was used. There are some limitations to such a study because, admittedly, radiocarbon is not the only source of carcinogenesis. Since rats are small and short-lived, it is possible that radiocarbon plays a less important role in their carcinogenicity. However, their metabolism is much higher on a per weight basis. Mammals follow the following formula for metabolic energy density, Y=400 × X-0.25, where Y is the metabolic energy density and X is the weight of the animal. Rats process about 4 times as much energy for the same amount of tissue mass as humans, assuming a typical human weighs 256 times a typical rat. However, such experiments would be a good starting point. Furthermore, it has been found that the mouse genome is less stable and there are fewer safeguards against cancer-causing insults (Holliday, 1996), so this may make up for the shorter lifespans and smaller size. Larger mammals could also be used, such as the oncopig, but the experiment would take longer and be more expensive.

Conclusion

There seems to be several lines of evidence to support the thesis that levels of radiocarbon were lower before Noah's Flood and that this low level of radiocarbon may have been responsible for the almost millennial lifespans of the prediluvian people. Experiments could be done to test this idea. If these experiments turn out to support this thesis, then, not only does it create a strong scientific validation for a difficult part of the Genesis history, but it would also allow humans to significantly extend our lifespans. Even if we could live one and a half centuries in health, that would be a transformative change for humanity. This might also impact the conversation about the impact of climate change, since an increase in atmospheric CO_2 would dilute C-14 and potentially lead to a positive effect of producing a worldwide increase in lifespans. Most importantly, I believe that being able to explain the cause of those long lifespans could be one of the most significant proofs for the veracity of the book of Genesis and would have tremendous evangelistic utility.

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