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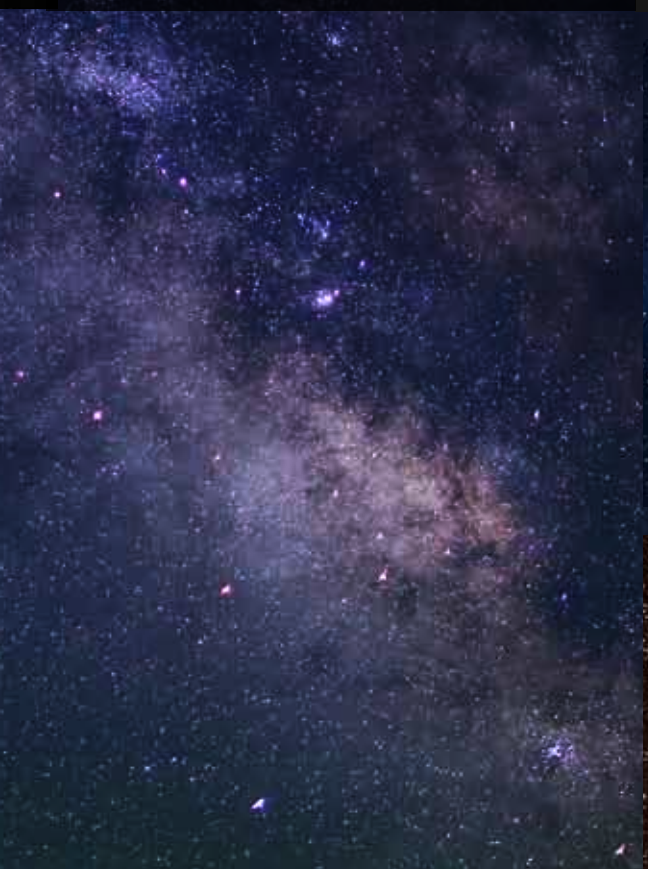

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QUARTERLY

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Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh. —Exodus 20:11

Cover by Michael E. Erkel, Afton, Virginia

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Design services by Cindy Blandon, cblandon@aol.com

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Editorial

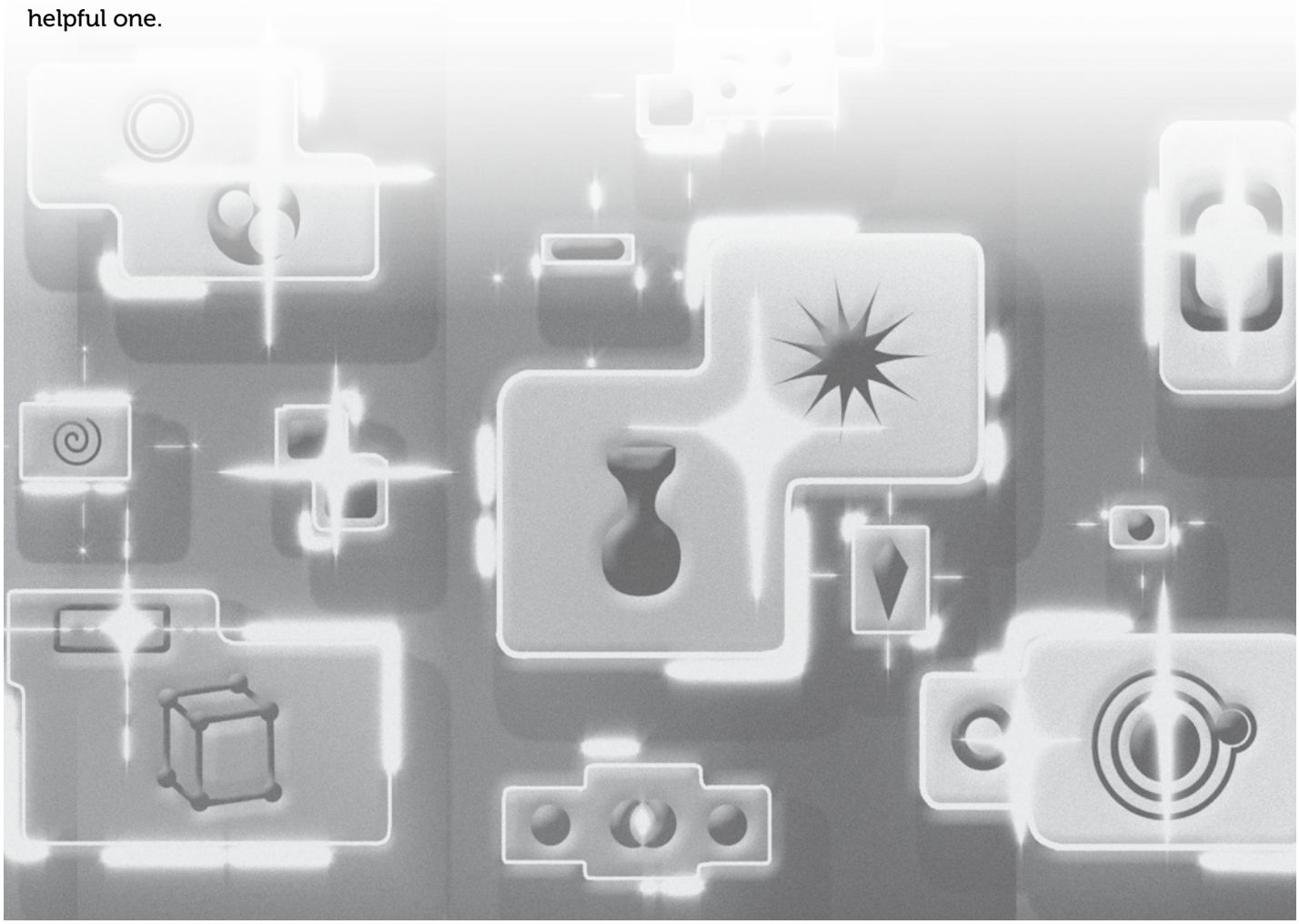
AI-Generated Simple Summaries

Beginning in CRSQ Volume 62, readers will notice we have added an AI-generated, Simple Summary to each research article. This short, one-paragraph, less technical summary appears below the paper's abstract and just prior to the introduction. And, yes, each summary is approved by the author(s) of the paper.

Some readers have expressed an interest in a simplified synopsis of each article. Other technical journals have also begun to do something similar. I hope this new addition is a welcome one and a helpful one.

In the near future, we also plan to allow open access to the previous year's CRSQ once the entire volume is complete. In other words, once Volume 62 is complete and Volume 63 begins, all articles in Volume 62 will become open access.

Timothy L. Clarey
Editor
Creation Research Society Quarterly



Chloroplast Genome-Based Molecular Baraminology Analysis of Proteales

Matthew Cserhati

Key Words: chloroplast, molecular baraminology, Nelumbonaceae, Platanaceae, Proteaceae, Sabiaceae

Accepted for publication June 10, 2024

Abstract

Proteales (or proteans) is an order of eudicot angiosperm plants that have economic and medicinal importance. The chloroplast genome of 18 Proteales species, together with four outgroup species from the genus *Cucurbita* were downloaded, aligned, and clustered. According to the results, the Hopkins clustering statistic was 0.801, which reflects decently good clustering. Five putative groups were found: *Platanus, Sabia, Meliosma, Nelumbo,* and the family Proteaceae (*Macadamia+Grevillea+Helicia*). Similarities based on pollen morphology also lend support to this division of Proteales species into these five tentative holobaramins. Hybridization data within the genera *Platanus* and *Nelumbo* and between *Helicia* and *Macadamia* also imply that these groups may be putative holobaramins. Further evidence from mitochondrial genomes, nuclear genes, or more hybridization data would strengthen these clusters.

Simple Summary

Scientists are trying to understand how plants are grouped into "created kinds" (also called **holobaramins**), which are groups of species that can reproduce with each other but not with other groups. To do this for a group of plants called **Proteales** (which includes macadamia nut trees and lotus flowers), they studied the plants' **chloroplast genomes**. Chloroplasts are like tiny power factories in plant cells that produce sugar, and their DNA blueprint is very stable and similar within a kind, making it useful for identifying these groups. By looking at the chloroplast DNA of 18 Proteales species and four outgroup species from the *Cucurbita* genus (like gourds), the researchers found **five likely "kinds"** within Proteales: **Platanus** (plane trees), **Sabia** plants, **Nelumbo** (lotus flowers), and a group from the **Proteaceae family** that includes *Macadamia*, *Grevillea*, and *Helicia* species. For example, the *Platanus* trees show high genetic similarity and are known to hybridize, supporting them as a kind, and the *Nelumbo* lotuses also form a strong group with fertile hybrids. Although the Proteaceae group is promising due to its unique pollen, the scientists emphasized that the findings for some of these groups are **tentative** and need **more evidence** from other DNA sources (like mitochondrial or nuclear DNA) or more observations of natural hybridization to be completely sure of these "kind" boundaries.

Introduction

Baraminology is the study of the created kinds, as mentioned in the Genesis creation account. A kind, or holobaramin, can be described as a reproductive community consisting of species that are continuous with one another and discontinuous with all other species (Wood, 2006). Studies in baraminology aim to use various kinds of data (the Bible, hybridization data, DNA sequences, morphological, ecological, and behavioral data) to classify species into their appropriate baramins.

Proteales (proteans) is an order of eudicot angiosperm plants that live in North America, Southeast Europe, the Middle East, Australia, South Africa, Madagascar, and Southeast Asia. Taxonomists usually assign four families to this group, including Proteaceae, Platanaceae, Nelumbonaceae, and Sabiaceae (The Angiosperm Phylogeny Group, 2009). These families in turn consist of 85 genera and around 1,750 species. The order is dominated by the family Proteaceae with 80 genera and about 1,615 species.

Some of these species are used as medicinal plants (Wen et al., 2016),

such as *Sabia parviflora* Wall. ex Roxb. (Chen et al., 2021). Some Proteales species exhibit high antifungal activity (Pauw and Eloff, 2014), but not so much antibacterial activity. Other species are of economic importance due to their ornamental qualities, timber, and oil-lubricating qualities (Cheng et al., 2023).

These plants are morphologically diverse trees and shrubs, with small individual flowers that are combined into dense floral clusters called inflorescences. Well-known species such as the silky oak (*Grevillea robusta*), the macadamia nut tree (*Macadamia ternifolia*), the oriental plane tree (*Platanus orientalis*), and the sacred lotus (*Nelumbo nucifera*) belong to Proteales. Researchers have noted the gaps in gross morphology between the four families that belong to this order (Gobo et al., 2023).

Several hybrid species are known from these four families. For example, the London plane (*Platanus x hispanica*) is a hybrid of the American sycamore (*P. occidentalis*) and the Oriental plane tree (*P. orientalis*). There is also evidence that *P. rzedowskii* is a hybrid of *P. mexicana* and *P. occidentalis* (Grimm and Denk, 2008).

The chloroplast genome is highly conserved in terms of genome structure, GC [Guanine-Cytosine] content, gene content, and gene order (Wicke et al., 2011; Chen et al., 2022). This means that it is possible that all species within a given holobaramin all have very similar chloroplast genome structures. Since chloroplast genomes are independent of the nuclear genome, they can be used to identify species, and map phylogenetic relationships between various plant groups (Parks et al., 2009; Daniell et al., 2016).

Previous chloroplast genome studies include 163 species from the order Liliales (Cserhati, 2023) and 28 species from Cucurbitaceae (Cserhati, 2024, submitted). Cucurbit chloroplast genomes have also been analyzed (Brophy et al., 2023). A study of chloroplast genomes from 306 Myrtales species and the cytochrome oxidase I (COI) gene from 18 species was also analyzed by Di Martino et al. (2024).

Proteales was chosen in this study because it contains a much smaller number of species than other chloroplast genome-based studies (Cserhati, 2023, 2024; Di Martino et al., 2024). When a larger number of groups are analyzed, the discovered groups may be an artifact of a large number of species. In this study, 27 species of Proteales were analyzed, which is about ten times less than the approximately 300 species studied in Myrtales (Di Martino et al., 2024).

Biblical Analysis

Species from the order Proteales are not mentioned in the Bible. However, along with all other plants, they were created on Day 3 of Creation Week.

Materials and Methods

The chloroplast genome sequences of 18 species from Proteales were downloaded from NCBI at: https://www.ncbi.nlm.nih.gov/nucleotide. The species name, the accession, the corresponding family, GC%, and genome length are listed in Supplementary File 1. Four species from the genus *Cucurbita* were used as a control outgroup, since they are known to belong to a different baramin.

The genome sequences were aligned using MAFFT, version 7.505 (Katoh et al., 2002). Using a self-written R script, the sequence distance matrix was assembled using the 'dist.alignment' method from the 'seqinr' package. Figures 1 and 2 were created using ggplot2, and the heatmap in Figure 2 was created using the 'ward.D2' clustering algorithm in the heatmap command. See Cserhati (2023) for a more detailed description of the methods used in this analysis.

Silhouette analysis was performed in R using the 'silhouette' method. Silhouette plots were calculated using the 'fviz_silhouette' method. Two to eleven clusters were analyzed to calculate their average silhouette width, and the cluster number with the maximum value was chosen for further analysis.

Supplementary File 1, the supplementary figures and the R script used in this analysis can be found online on the Zenodo website at https://zenodo.org/records/11495534.

Results and Discussion

In Figure 1, we can see the 22 species in this study plotted for GC% and chloroplast genome length. While we cannot discern whether many species cluster into their own group, we do see that members of the genera *Sabia*, *Platanus*, and *Nelumbo* separate from one another (see Table I). These groups might be putative holobaramins. The outgroup *Cucurbita* also forms its own cluster in the lower left. It is puzzling that the two species of *Meliosma* (*M. aff. cuneifolia* and *M. oldhamii*) differ from one another somewhat significantly (although *M. aff. cuneifolia* does cluster near *Sabia* from the same family).

A total of seven putative clusters were found in our data, as shown in Figure 2. The Hopkins clustering statistic was 0.801, which indicates good clustering. Of these seven groups, only three (*Macademia+Grevillea+Helicia*, *Nelumbo*, and *Cucurbita*) were statistically significant at the 5% level. Two other groups had less than three species, therefore their statistics were not robust. These clusters and accompanying statistics can be seen in Supplementary File 1. Silhouette plot analysis revealed that the maximum average silhouette width was 0.66 for seven clusters. Two to eleven clusters were analyzed to estimate the optimal number of clusters present in the data set. (Figure 3).

The gene content and gene order are the same in the genera *Macadamia*, *Platanus*, and *Nelumbo*, which share 79 protein-coding genes, 30 tRNA, and 4 rRNA genes. Size differences are due to expansion of the inverted repeat (IR) regions, and reduction in the large and small single copy regions (LSC and SSC) in *Macadamia* relevant to *Platanus* (Nock et al., 2014).

Two genomes from the genus *Sabia* (*Sabia yunnaensis* and *Sabia parviflora*) form a clear cluster at the top right of the heatmap in Figure 2. The chloroplast genomes of *Sabia* are relatively conserved, with 85 coding genes, 37 tRNA genes, and eight rRNA genes. Terpenoids, alkaloids, and flavonoids have been extracted from *Sabia* to treat rheumatoid arthritis, trauma, hepatitis, and other illnesses. The GC% doesn't vary much and is between 38.56%–38.73%. No specific structural variation has been found in this genus (Chen et al., 2022). The clustering added *Meliosma aff. cuneifolia* to this group, but the p-value was insignificant (p=0.18). Therefore these two genera more likely belong to separate holobaramins.

Two species from the genus *Meliosma* (*Meliosma oldhamii* and *Meliosma aff. cuneifolia*, see top right, Figure 2) showed a large difference between one another, so that they were classified initially as members of two separate holobaramins. Their sequence similarity is 0.671. The sequence similarity between *M. oldhamii* and *Sabia yunnaenesis* is 0.669, not much different. It appears that just as *M. oldhamii* and *S. yunnaensis* belong to separate baramins, so would the two *Meliosma* species. The big question is what could cause such a large sequence difference between these two species? Both species have 85 protein-coding genes, 37 tRNA genes, and eight rRNA genes. Despite overall structural similarities, seven protein-coding genes (ndhB, rps12, rps7, rp12, rp123, rps19, and ycf2), as well as seven tRNAs (trnA-UGC, trnI-CAU, trnI-GAU, trnL-CAA, trnN-GUU, trnR-ACG, and trnV-GAC), and four rRNA genes (23S, 16S, 5S, and 4.5S) are duplicated in *M. oldhamii* (Cheng et al., 2023), which may explain the differences in the chloroplast genome

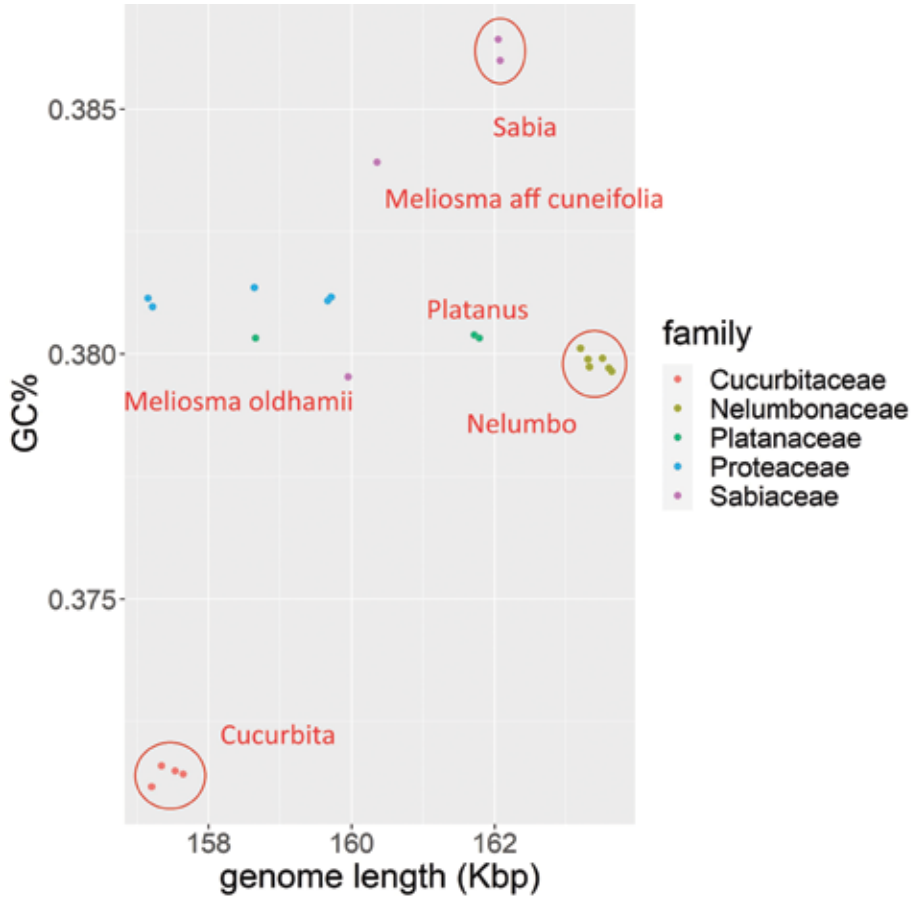


Figure 1. Chloroplast genome length (Kbp) and GC% [Guanine + Cytosine %] of the 18 Proteales species (plus the four outgroup *Cucurbita* species) included in this study. Species forming visible groups are circled.

Table I. Average genome length and GC% of several genera on the genome length/GC% plot.

Group/species	Genome length	GC%
Sabia	162,068±18 bp	38.62±0.031%
Nelumbo	163,432±160 bp	37.98±0.016%
Platanus	161,755±37 bp	38.01±0.003%
Cucurbita	157,431±196 bp	37.14±0.018%
Meliosma aff cuneofolia	160,358 bp	38.39%
Meliosma oldhamii	159,951 bp	37.95%

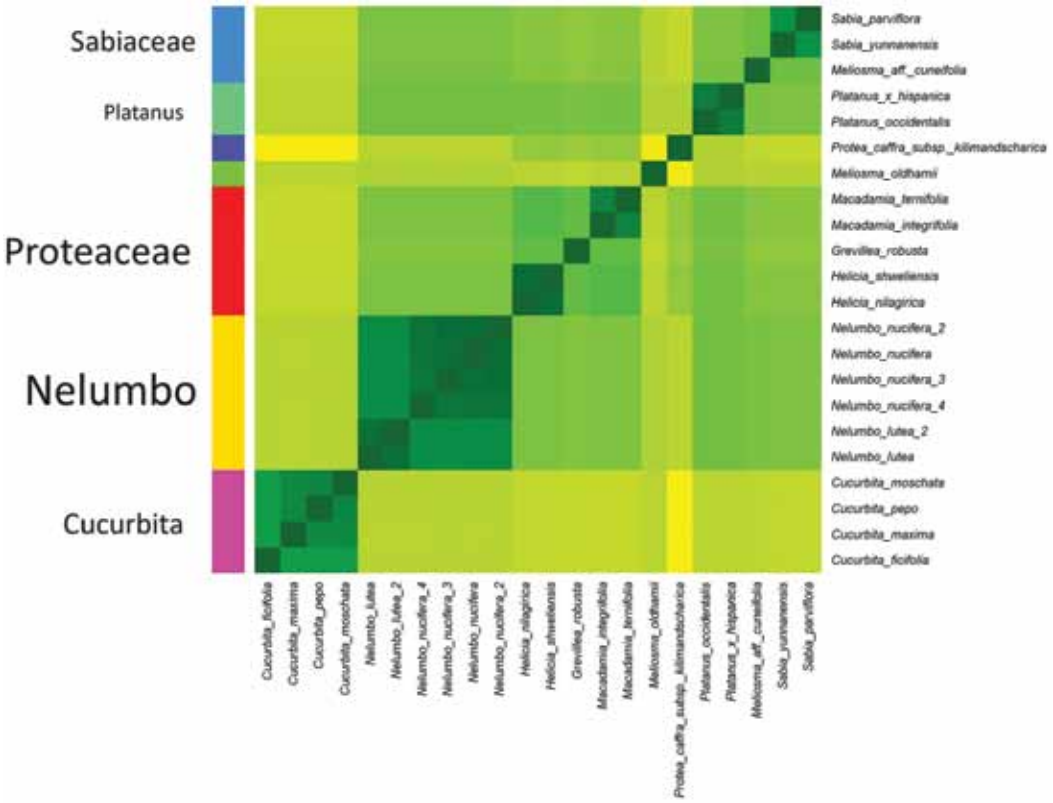
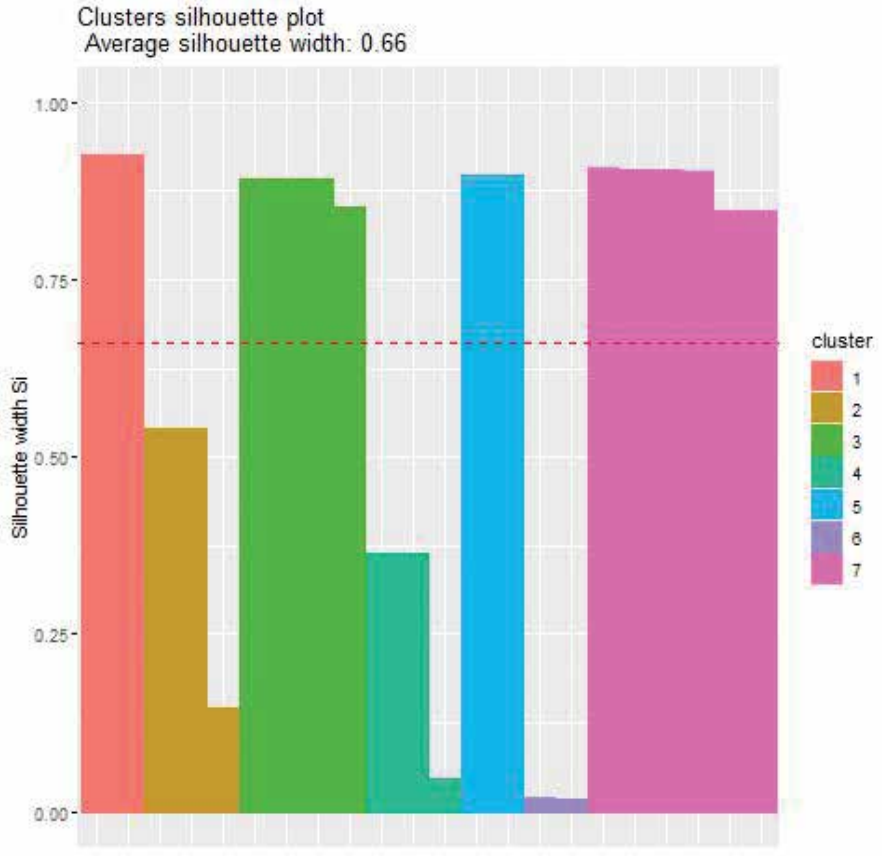


Figure 2 ***(right)*****. Heatmap showing the baraminic relationships of the 21 species in this study. Darker, greener colors indicate high sequence similarity between species, which belong to the same putative holobaramin. Lighter, yellower colors indicate lower sequence similarity values representing species from two different holobaramins.**

Figure 3 ***(lower right)*****. Silhouette plot showing the maximum average silhouette width value of 0.66 for an optimal number of seven clusters.**



sequence that contribute to such a large sequence distance. Taking this into account could mean that the two *Meliosma* species belong to the same holobaramin, after all.

The genus *Platanus* is made up of two species (second cluster from top right in Figure 2), *Platanus occidentalis* and *P. x hispanica*. The sequence similarity value between these two species is 0.966. The fossil record of *Platanus* is more diverse, in line with mass extinctions happening in the past, possibly during the Genesis Flood (Grimm and Denk, 2008). Some evidence based on sequence comparisons of the internal transcribed spacer (ITS) suggest widespread hybridization between various members of this genus (Grimm and Denk, 2008), suggesting that it is a holobaramin. The pollen in this genus

is generally uniform, especially with regards to the pollen size, the pattern of the reticulum, and the shape and size of the colpi. However, the pollen of *P. kerrii* differs from other species based on its high reticulum and folded shape, although this species was represented by only one sample in the study of Denk and Tekleva (2006).

The genus *Nelumbo* (group #4 from top right, Figure 2) consists of six genomes from two species, forming a well-defined cluster ($p=1.7x10^{-30}$). This genus is considered to be a living fossil, not having changed in morphology over its historical lifespan (Sanderson, 2001; Nock et al., 2014). The genus contains only two species, *N. lutea* (the American lotus) and *N. nucifera* (the sacred lotus), which have fertile hybrids (Xue et al., 2012). Several authors place *Nelumbo* into its own family because of its unique triaperturate pollen. Others think that any physical similarities in pollen between *Nelumbo* and water lilies from the order Nympheales are superficial (Kreunen and Osborn, 1999).

The two species from *Helicia*, *H. nilagirica* and *H. shweliensis*, form a significant cluster together with *Grevillea robusta*, *Macadamia integrifolia*, and *M. ternifolia* ($p=2.8x10^{-5}$) in Figure 2. All five of these species are members of the family Proteaceae. Niu and Liu (2020) also found that *H. nilagirica* and *M. integrifolia* cluster together very closely. They suggest that *H. nilagirica* may be used as rootstock or as a gene donor in macadamia breeding. This suggests that these two species may be able to hybridize, meaning that they might possibly be part of the same holobaramin. This grouping is highly tentative, since hybrids between *Helicia*, *Macadamia*, and *Grevillea* have not been observed. However, the porate structure of pollen from Proteaceae as well as the pattern of aperture positions on the meiotic tetrads of this family is unique among angiosperms (Sauquet and Cantrill, 2007). This may indicate the holobaraminic (and also monobaraminic) status of the family Proteaceae, although one must keep in mind that pollen may vary even among species within the same group. A monobaramin is a subset of a holobaramin, something like a lineage of species within the larger group.

Protea caffra subsp. kilimanscharica forms a cluster all by itself. In the lower right corner of Figure 2, the four outgroup species from the genus *Cucurbita* can be seen. These form a highly significant cluster ($p=6.7x10^{-9}$) and are separated from the Proteales by the lowest levels of similarity in the heatmap analysis.

Conclusion

The chloroplast genomes of 18 species of Proteales were analyzed. Several putative holobaramins were found at the level between the genus and the family. These include the genera *Platanus* (Platanaceae), *Sabia* (Sabiaceae), *Meliosma* (Sabiaceae) and *Nelumbo* (Nelumbonaceae), and the family Proteaceae (*Macadamia+Grevillea+Helicia*). Since two of these four genera belong to different families, and since the family is generally regarded as the level of the kind, this may indicate that these groups are holobaramins. The last group is very tentative, and more additive evidence are necessary to verify whether these three genera are either monobaramins within the same holobaramin or separate holobaramins altogether. The baraminic delineations of these groups may be solidified with more additive evidence, such as the examination of mitochondrial or hybridization data, or individual nuclear genes. Due to the small number of species and the limited amount of data, this is a preliminary study on the molecular baraminology of Proteales. Further analysis of mitochondrial and nuclear DNA would help further establish the present findings.

References

The Angiosperm Phylogeny Group. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society* 161:105–121. https://doi.org/10.1111/j.1095–8339.2009.00996.x.

Brophy, Timothy R., Jack R. Gregory, and Brigitte Townsend. 2023. Hybridization and genetic distances suggest one large monobaramin in the gourd family (Cucurbitales: Cucurbitaceae) [poster]. In J.H. Whitmore (editor), *Proceedings of the Ninth International Conference on Creationism*, pp. 657–658. Cedarville University International Conference on Creationism, Cedarville, Ohio.

Chen, Q., C. Chen, B. Wang, Z. Wang, W. Xu, Y. Huang, and Q. Sun. 2022. Complete chloroplast genomes of 11 Sabia samples: Genomic features, comparative analysis, and phylogenetic relationship. *Frontiers in Plant Science* 13: 1052920. https://doi.org/10.3389/fpls.2022.1052920.

Chen, Q., W. Xu, C. Zhao, B. Wang, C. Chen, Q. Liu, Q. Sun, Q., and Y. Huang. 2021. Complete chloroplast genome of medicinal plant *Sabia parviflora* Wall. ex Roxb. (Sabiaceae). *Mitochondrial DNA. Part B, Resources*, 6(7): 1924–1925. https://doi.org/10.1080/23802359.2021.1935350.

Cheng, Y., X. Xu, L. Tong, L. Tian, C. Xia, and X. Yu. 2023. Complete chloroplast genome and phylogenetic analysis of *Meliosma oldhamii* Miq. ex Maxim. (Sabiaceae). *Mitochondrial DNA. Part B, Resources* 8(11):1306–1310. https://doi.org/10.1080/23802359.2023.2281034.

Cserhati, M. 2023. Chloroplast genome-based baraminology study of Liliales. *Creation Research Society Quarterly* 60(2):84–96.

Cserhati, M. 2024. Baraminology of Cucurbitaceae based on chloroplast genome analysis. *Answers Research Journal*, *submitted*.

Daniell, H., C.S. Lin, M. Yu, and W.J. Chang. 2016. Chloroplast genomes:

Diversity, evolution, and applications in genetic engineering. *Genome Biology* 17(1):134. https://doi.org/10.1186/s13059–016–1004–2.

Denk, T., and M.V. Tekleva. 2006. Comparative pollen morphology and ultrastructure of Platanus: Implications for phylogeny and evaluation of the fossil record. Grana 45(3):195–221. https://doi.org/10.1080/00173130600873901.

Gobo, W.V., L. Kunzmann, R. Iannuzzi, T.B. Dos Santos, D.M. da Conceição, D. Rodrigues do Nascimento Jr, W.F. da Silva Filho, J.B. Bachelier, and C. Coiffard. 2023. A new remarkable Early Cretaceous nelumbonaceous fossil bridges the gap between herbaceous aquatic and woody protealeans. *Scientific Reports* 13(1): 8978. https://doi.org/10.1038/s41598–023–33356-z.

Grimm, G.W., and T. Denk. 2008. Its evolution in Platanus (Platanaceae): Homoeologues, pseudogenes and ancient hybridization. *Annals of Botany* 101(3):403–419. https://doi.org/10.1093/aob/mcm305.

Katoh, K., K. Misawa, K. Kuma, and T. Miyata. 2002. MAFFT: A novel method for rapid multiple sequence alignment based on fast Fourier transform. *Nucleic Acids Research* 30(14):3059–3066. https://doi.org/10.1093/nar/gkf436.

Kreunen, S.S., and J.M. Osborn. 1999. Pollen and anther development in Nelumbo (Nelumbonaceae). *American Journal of Botany* 86(12):1662–1676.

Niu, Y.F., and J. Liu. 2019. Complete chloroplast genome of *Helicia nilagirica* Bedd. and its phylogenetic analysis. *Mitochondrial DNA. Part B, Resources* 5(1):342–343. https://doi.org/10.1080/23802359.2019.1703587.

Nock, C.J., A. Baten, and G.J. King. 2014. Complete chloroplast genome of Macadamia integrifolia confirms the position of the Gondwanan early-diverging eudicot family Proteaceae. *BMC Genomics* 15 Suppl 9(Suppl 9):S13. https://doi.org/10.1186/1471–2164–15-S9-S13.

Parks, M., R. Cronn, and A. Liston. 2009. Increasing phylogenetic resolution at low taxonomic levels using massively parallel sequencing of chloroplast genomes. *BMC Biology* 7:84. https://doi.org/10.1186/1741–7007–7-84.

Pauw, E., and J.N. Eloff. 2014. Which tree orders in southern Africa have the highest antimicrobial activity and selectivity against bacterial and fungal pathogens of animals? *BMC Complementary and Alternative Medicine* 14:317. https://doi.org/10.1186/1472–6882–14–317.

Sanderson, M.J., and J.A. Doyle. 2001. Sources of error and confidence intervals in estimating the age of angiosperms from rbcL and 18S rDNA data. *American Journal of Botany* 88(8):1499–1516. https://doi.org/10.2307/3558458.

Sauquet, H., and D.J. Cantrill. 2007. Pollen diversity and evolution in Proteoideae (Proteales: Proteaceae). *Systematic Botany* 32(2):271–316. https://doi.org/10.1600/036364407781179743.

Wicke, S., G.M. Schneeweiss, C.W. dePamphilis, K.F. Müller, and D. Quandt. 2011. The evolution of the plastid chromosome in land plants: Gene content, gene order, gene function. *Plant Molecular Biology* 76(3–5):273–297. https://doi.org/10.1007/s11103–011–9762–4.

Wood, T.C. 2006. The current status of baraminology. *Creation Research Society Quarterly* 43(3):149–158.

Xue, J., S. Wang, and S.L. Zhou. 2012. Polymorphic chloroplast microsatellite loci in Nelumbo (Nelumbonaceae). *American Journal of Botany* 99(6):e240–e244. https://doi.org/10.3732/ajb.1100547.

The Kallikak Family Eugenics Fraud and the Harm That It Has Caused

Jerry Bergman

Key Words: eugenics, feeble-mindedness, fraud in science, the harm of Darwinism, Henry Goddard, Jukes Family, Kallikak Family, natural selection, Nazi Germany

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Abstract

Every society has some citizens who do not live up to what that society considers appropriate behavior. A once-common label for some of these persons was "feeble-minded." Inspired by Darwinism, Harvard-trained biologist Charles Davenport, and a one-time Ohio State University psychology professor, Henry Goddard, located a family whom they believed supported their eugenic belief that feeble-mindedness was, at the least, partly inherited.

In a futile effort to protect their identities, the pseudonym "Kallikak" was given to the family chosen for the case study. Great consequences resulted from Davenport and Goddard's research including fueling support for American and German eugenic policy. In Germany, it eventually resulted in the Holocaust. A careful investigation has determined that the Kallikak study was fraudulent, and in the end, badly misled. The persons responsible for the fraud likely included Goddard and the fieldwork project director Elizabeth Kite. The disastrous result was that an entire family and family history, as well as some of the people connected with the research, experienced slander that left an indelible mark on their lives.

Simple Summary

The article, "The Kallikak Family Eugenics Fraud and the Harm That It Has Caused," explains how the Kallikak Family study, published in 1912 by Henry Goddard, was a major scientific fraud that greatly supported the eugenics movement. Influenced by Darwinism, Goddard and other eugenicists believed that traits like "feeble-mindedness" (a term for people deemed unintelligent or prone to bad behavior) were inherited, and they thought that preventing "inferior" individuals from having children would improve human society. The Kallikak study claimed to prove this by tracing two family lines—one supposedly "bad" due to a "feeble-minded" ancestor and one "good"—but it was built on made-up stories, misleading altered photographs, and careless research. Even though the study was later proven false due to its lack of real science and clear biases, it caused terrible harm, contributing to the forced sterilization of over 70,000 people in the United States and inspiring Nazi Germany's eugenic programs, which ultimately led to the deaths of millions. The article emphasizes that this study serves as a frightening example of how personal opinions and unfair judgments can wrongly impact scientific work and result in serious injustice.

Introduction

In 1912, Professor Henry Goddard (1866–1957) published a book titled *The Kallikak Family* which became a best-seller and turned Goddard, "a psychologist at a little-known backwoods institution—into one of the most famous scientists in the United States" (Zimmer, 2018, p. 87). The results of the Goddard study were accepted partly because eugenics itself was widely accepted both in the United States and Germany (Black, 2003). The entire Kallikak study has now been proven to be fraudulent, consisting of fabricated stories foisted on an educated society wanting to believe the Darwinian myth that innate to humanity were "laws" that regulated inferiority and superiority (Smith and Wehmeyer, 2012).

The study supported the belief that the so-called "feeble-mindedness problem" could be ameliorated by eugenics (Smith, 1985). Eugenics, from the Greek *eu*, meaning "good," and *genetics*, thus *good genetics*, was developed largely by Darwin's cousin, Sir Francis Galton, earning him the dubious distinction of being widely recognized as the "Father of Eugenics" (Gillham, 2001; Aubert-Marsonm, 2009).

Eugenics was a method of improving the human race by discouraging, or even preventing, reproduction by persons that the eugenicists judged as "inferior." This included persons who were determined to be less-intelligent, prone to commit criminal acts, or even those who were more often likely to become inebriated. The main method was to determine who were the inferior people, not uncommonly a very subjective judgment, and then use legal means to prevent them from reproducing.

Conversely, those persons determined by the eugenicists to be genetically superior were encouraged to have large families. After the idea was proposed by Galton, eugenics soon had a wide variety of supporters, mostly evolutionists such as Henry Goddard. Goddard supported eugenics because he was convinced that eugenics was central to producing a superior, crime-free society.

While employed at the Vineland Training School, Goddard learned of a family living near the school whose offspring were determined to be feeble-minded, defective, and delinquents. This was the family that Goddard used for his eugenics research, surveying them over several generations, and giving them the pseudonym Kallikak. He appointed several persons who he believed were qualified to complete a historical study which was named *The Kallikak Family* study. "Martin" was the illegitimate son of an understood "feeble-minded" girl and the patriarch of the Kallikak family. *The Kallikak Family* study encompassed tracking Martin's 480 descendants. A major reason Henry Goddard accepted the results of *The Kallikak Family* study was because he was convinced that the field work supported the eugenic theory. How this happened and how it was debunked is the focus of this review of *The Kallikak Family* case study.

Darwin: Central to the Tragedy

The "survival of the fittest" idea, which was "critical to Darwin's *Origin*," became the "linchpin of subsequent arguments for eugenic sterilization and institutionalization of the feeble-minded" (Smith and Wehmeyer, 2012, p. 15). Darwinism was also a central motivation for Goddard's eugenic *Kallikak Family* study (Durst, 2017, pp. 19–24).

As a schoolboy in Providence, Rhode Island, Goddard had learned about evolution. His geology teacher "had taught the class the 'astonishing fact that the world was not made in six days, six thousand odd years ago, but had a history of uncounted and uncountable years'" (Zenderland, 1998, p. 31). Furthermore, because Goddard's teacher stressed evolution was a fact as "clear and plain" as the morning sunrise, most of his students wholeheartedly embraced evolutionary ideas.

Goddard was also taught "the marvelous story of the evolution of the horse [and]…[also] how the stages of the embryo child run in a parallel order to the stages of the order of evolving life" (Zenderland, 1998, p. 31). Both of these claims have long since been disproved (Gould, 1991, pp. 170–181; Jackson, 2017). When he accepted evolution, Goddard did not perceive any major conflict "between his Christian heritage and his new career as a scientist studying evolutionary theory" (Zenderland, 1998, p. 29). Nonetheless, as far as the question of human origins was concerned, Goddard's Christian background was now ignored. Furthermore, eugenics assumes that humans were not created, but rather evolved from some apelike common ancestor, and that some humans are more evolved than others.

Professor Goddard was trained and mentored by G. Stanley Hall at Clark University. Hall accepted the new psychology "based on a Darwinian re-conceptualization of 'mind' that challenged the older system" based on creationism (Zenderland, 1998, p. 29). This new theory taught that the human mind was a complex entity which evolved in response to its environment by natural selection. When Hall first learned about evolution, although a seminary graduate, he was "almost hypnotized by the word evolution" (Zenderland, 1998, p. 31). He then passed this enthusiasm onto Goddard, who was one of his most promising students. His enthusiasm was not unexpected: "social Darwinism was the great fashion of the day" (Gerstein, 2017, p. 13).

It was at Clark University where Goddard "was first exposed to the newly proclaimed science of eugenics" (Smith and Wehmeyer, 2012, p. 11). Goddard's acceptance of evolution enabled him to accept, and work to implement, the eugenic conclusions of Darwin's cousin, Francis Galton (Zenderland, 1998, p. 149). Goddard was so convinced that Darwinian eugenics could improve society that he embarked on what he thought was a critically important study to prove eugenics, namely his *Kallikak Family* research. His goal in doing the research was to spread the eugenics solution to social problems throughout the world.

Convinced of the eugenic solution to most major social problems, his study opened the door to the application of eugenics by preventing what

were determined to be "feeble-minded" girls from having children (Zenderland, 1998). The American eugenics movement soon spread to Germany. Eventually, the German euthanasia program led to the systematic murder of at least 10,000 people deemed physically and/or mentally disabled (United Holocaust Museum, 2024).

The Kallikak Family Study

The Kallikak Family study claimed to involve 450 families, wherein 65 percent of the children had the "hereditary taint" of feeble-mindedness (Goddard, 1912, p. viii). Goddard's goal was an in-depth investigation by trained interviewers to ensure the study's accuracy. The interviewers claimed to have made visits to the homes of all of those who were part of the study, which often required several visits to complete an assessment (Goddard, 1912, pp. xii–ix). Furthermore, Goddard stressed that labeling someone feeble-minded required evidence that was "beyond a reasonable doubt" (Goddard, 1912, p. ix).

The basis for the research was the American Revolutionary War soldier Martin Kallikak, Sr., who had purportedly sired a degenerate ancestral line from an affair with a feeble-minded barmaid. The offspring of this side, Goddard claimed, included drunks, criminals, and feeble-minded immoral persons. Martin, Sr., however, later did what was right and married an upstanding Quaker woman, becoming the father of a second line of descendants that included, as Goddard put it, "respectable citizens, men and women prominent in every phase of life" (Goddard, 1912, p. 31). The two sides of the family are illustrated in Figure 1.

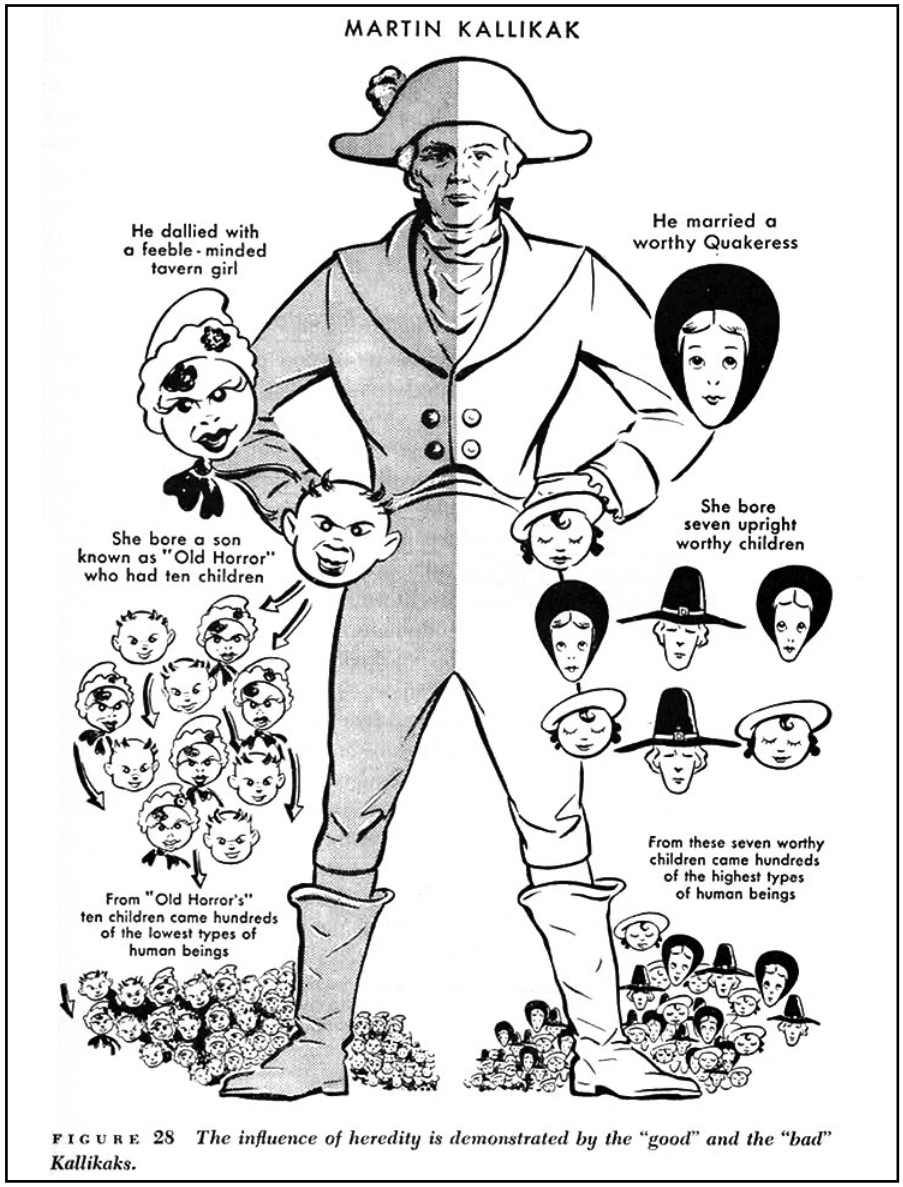

Figure 1. A revised copy of this illustration was reprinted in German Nazi textbooks to illustrate the major influence of race. Revised version seen in Figure 6. From the DNA Learning Center. https://dnalc.cshl.edu/view/15767-German-educational-slide-explaining-the-Kallikak-family-1924.html. Figure from Garrett, H. 1955. *General Psychology*, p. 65, American Book Company, New York, NY.

Problems with the Study Soon Noted

The first obvious problem with the study was that the father seemed not to affect the outcome of the progeny, only the mother did. One of the earliest critics to attack the viability of the Kallikak study was not a psychologist but a fruit-fly biologist researching genetics, Thomas Hunt Morgan. He, more than most readers, could "see how weak the foundations were on which Goddard built his story" (Zimmer, 2018, p. 97). Morgan realized from his genetics research that many genes were involved in most traits, both those from the father and those

from the mother. This was especially true of humans.

Morgan was appalled at how the Kallikak study supporters clung to the idea that one gene from the mother could produce complex traits "even as the evidence piled up against it" (Zimmer, 2018, p. 99). In view of the fact that little knowledge of the genetic basis for simple traits like eye color exists, how can it be expected that the genetic basis of complex conditions such as feeble-mindedness can be understood? Goddard speculated that normal intelligence was a dominant trait, and that feeble-mindedness was recessive, ignoring the fact that much of his data indicated the opposite conclusion (Durst, 2017, p. 62). Family dysfunction is, as a whole, not caused by some single inherited gene, but is the result of impoverished, uneducated people experiencing more than their share of major life hardships.

Another example of the study's many major problems is its conclusion that, of the "41 matings where both parents were feeble-minded, they had 222 feeble-minded children, with two others that were considered normal. These two are apparent exceptions to the law that two feeble-minded parents do not have anything but feeble-minded children" (Goddard, 1912, p. 114). The eugenicists' doctrine taught that two feeble-minded parents will *always* birth feeble-minded children.

As early as 1939, other major problems in *The Kallikak Family* research were noted. Oberlin College psychologist Lawrence Cole (1897–1979), after a careful reading of the published research, observed that other family studies, including the Jukes and Nams

> have revealed long lines shot through with feeble-mindedness, degeneracy, criminality, alcoholism, etc.,…yield[ed] descriptions but not explanations….in short, while there is a vast literature dealing with the inheritance of human traits and capacities, much of it is scientifically worthless and smacks more of special pleading than of an unbiased search for the facts. (Cole, 1939, pp. 240–241)

Cole concluded that "so lacking are these studies in scientific accuracy and completeness that no exercise of the scientific imagination can make up for the basic defects in the original data" (Cole, 1939, p. 241). No doubt Cole's critical evaluation of these studies based on social Darwinism were influenced by his Christian commitment.

Among the many other major problems Cole noted was the fact that the eugenic "feeble-minded" classification was so "sprawlingly vague" that many deaf people were placed under this generic label. They were often then called "deaf and dumb," as if these traits were synonymous (Zimmer, 2018, p. 70). This was especially common if the deaf person was not aware that they were deaf. The catch-all psychological and social term "feeble-minded" was used from the 1850s to at least the 1940s.

Other Problems in the Kallikak Story

One member of the Kallikak Family, known as Deborah, was part of the line descended from the "bad," feeble-minded woman. Deborah was forced to live in the Vineyard Institution for the Feeble-Minded in New Jersey for her entire life after Goddard headed the institution. Early reports of her progress indicated that she was fairly normal, although she was either a bit slow or unmotivated (Durest, 2017, p. 45). Goddard described her as a high-grade moron, typical of the females that filled reformatories then. In stark contrast to Goddard's claim, she was an accomplished young woman, given the confines of the institution (see illustrations, Figures 3–6). Evidently, Deborah was originally placed in the reformatory because her stepfather did not want children in his household that were not biologically his (Smith and Wehmeyer, 2012a).

Figure 2. Deborah indulging in her favorite activity: reading with her cat on her lap. She loved animals, and they loved her. She enjoyed romance novels and historical fiction as many women do today. Knowing that she was labeled feeble-minded and living in an institution for the feeble-minded, she realized her opportunities for romance were not very good. From Goddard, H. 1912. *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. Macmillan Publishers, New York, NY.

One observation, based on the photographs of Deborah, is how normal she looked while pursuing her various interests and avocations. Although the Kallikak report claimed that she could "neither read nor write" (Bjorkman, 1911, p. 329), the most commonly published picture shows her as an attractive, slim woman engaging in her

favorite activity, reading (Figure 2). As a young adult, Deborah was described as a good-looking, handsome young woman (Smith, 2012, p. 205). (See Figure 5 from Goddard, 1912, photo facing p. 9, and also Figure 7.)

Judging from photographs of her work, she mastered the many and varied skills required to pursue different interests, including embroidery, basketry, and woodworking (Figures 3 and 4 from Goddard, 1912, photo facing pp. 4 and 7). She also played the cornet beautifully, and, as a talented actress, she filled star roles in the performances put on by the Vineland Training School (Smith, 2012, p. 205). Deborah also helped to care for the children of the institution's employees (Reeves, 1938). The children adored her, some sending letters to her for the rest of her life.

One revealing statement was, Goddard admitted that "average citizens would not be able to recognize the feeble-minded in their midst," leaving this task to the professionals (Durst, 2017, pp. 60–61). At the age of 25, after having lived at the Vineland Training School for 17 years, Deborah was transferred to the women's institution across the street (Reeves, 1938). She died in 1978, at the age of 89, after having lived in an institution for 81 of those years.

Figure 3. Deborah was multi-talented and had many skills besides sewing, including woodworking, cabinet making, and embroidery, some of which are pictured above. From Goddard, H. 1912. *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. Macmillan Publishers, New York, NY.

The Study's Credibility Demolished

After some detective work, genealogists David Macdonald and Nancy McAdams learned that Deborah's real name was Emma Wolverton (Zimmer, 2018, p. 86). Once her name was confirmed, most of her relatives could be located. From this point on the tools of genealogy were used to replicate close to the entire original study. In the only major investigation of the Kallikak study, Columbia University professor J. David Smith, Ph.D., demolished the evidence that eugenicists had used in their attempt to prove the viability of eugenics as a major solution of many societal problems.

Smith concluded that an unscientific methodology was used to "prove" the inherited-poverty eugenic theory of feeble-mindedness and criminality

Figure 4. Another talent was her competence as a master seamstress. From Goddard, H. 1912. *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. Macmillan Publishers, New York, NY.

(Smith and Wehmeyer, 2012a). Much of the blame for the study's lack of credibility was attributed to Goddard's main fieldworker, a former school principal named Elizabeth Kite.

Goddard assumed that she was qualified because she studied at the Sorbonne and the University of London (Zimmer, 2018, p. 81). However, it was later proven that Kite's research was at best "sloppy." She conducted only a few valid interviews, not the 450 the study called for. Further discrediting her work was the fact that her labeling persons feeble-minded was done so haphazardly that any competent investigator would confirm that her labelling was irresponsible. In spite of these problems, the "*Kallikaks* was a highly influential monograph that fomented public fears of the menace of the feeble-minded….Eugenic family studies began to assume the aura of scientific probity even though prejudicial strains recur frequently in their pages" (Durst, 2017, p. 47).

One major foundation of the Kallikak story was the claim that the soldier John Wolverton had a son (also named John Wolverton) born out of wedlock from a feeble-minded tavern girl. However, the reevaluation proved that the younger John Wolverton was *not* his illegitimate son, but rather his second cousin (Smith, 2012). Furthermore, the "Old Horror," Martin Kallikak, was *not* the son of an unwashed drunk as claimed, but a respectable landowner. Most of the family members that were part of the "bad" Kallikaks (described by the institution Goddard worked for as violent, irresponsible, promiscuous drunks), actually did quite well, considering their rural, impoverished country background. Many were hard workers with good, stable marriages (Smith, 2012).

The investigation conclusively determined that all of the major claims Goddard made about the families were demonstrably false. In short, as more and more similar problems were discovered, it became clear that "Goddard's natural experiment in heredity never happened" (Zimmer, 2018, p. 103).

Teaching Eugenics in America

One of the worst examples of eugenic indoctrination was in the textbook used by John Scopes titled *A Civic Biology* by George William Hunter, published in 1925. This textbook, which openly taught racism, contained an entire chapter on eugenics based on the Kallikak study. For nearly a decade in the early 1900s, Hunter's book was the most widely used high school science textbook in the nation (Bergman, 2004).

The textbook was endorsed by many distinguished professors, including those at elite universities such as Brown and Columbia (Larson, 1997). Hunter wrote, or co-wrote, 20 textbooks in addition to *Civic Biology*, including his *New Essentials of Biology*, which was reprinted in 1923, and his *Problems in Biology*, published by the American Book Company and reissued as late as 1939.

Hunter's *Civic Biology* text described the Kallikak study in glowing terms as definitive proof of the inheritance of feeble-mindedness, alcoholism, immorality, and criminality (Hunter, 1914, pp. 261–263). Hunter exclaimed that solving these many social problems required identifying the human genetic carriers of maladies such as feeble-mindedness. Last, sterilize them to ensure that these traits were eventually eradicated from the human gene pool (Hunter, 1925, p. 263). In Hunter's words, the cost of feeble-minded persons to society was enormous:

> In seventy-five years, the progeny of the original generation has cost the state of New York over a million-and-a-quarter dollars, besides also having given over to the care of prisons and asylums considerably over a hundred feeble-minded, alcoholic, immoral, or criminal persons. (Hunter, 1914, pp. 262–263)

Hunter then reviewed the case of the "Kallikak" family which was

> traced back to the War of the Revolution, when a young soldier named Martin Kallikak seduced a feeble-minded girl. She had a feeble-minded son from whom there have been to the present time 480 descendants. Of these, 33 were sexually immoral, 24 confirmed drunkards, 3 epileptics, and 143 feeble-minded. The man who started this terrible line of immorality and feeble-mindedness later married a normal Quaker girl. From this couple a line of 496 descendants have come, with no cases of feeble-mindedness. The evidence and the morals speak

> for themselves! (Hunter, 1914, pp. 262–263)

This book "was used by American public schools for several generations despite the fact that it expounded the very dogma central to Hitler's National Socialism [Nazism]" (Samaan, 2020, p. 298). From research similar to that of the Kallikak Family study, Hunter concluded that

> Hundreds of families such as those described above exist today, spreading disease, immorality, and crime to all parts of this country. The cost to society of such families is very severe. They not only do harm to others by corrupting, stealing, or spreading disease, but they are actually protected and cared for by the state out of public money. Largely for them the poorhouse and the asylum exist. They take from society, but they give nothing in return. They are true parasites. (Hunter, 1914, p. 263)

The remedy Hunter proposed, closely echoing the words of Darwin, was as follows:

> If such people were lower animals, we would probably kill them off to prevent them from spreading. Humanity will not allow this, but we do have the remedy of separating the sexes in asylums or other places and in various ways preventing intermarriage and the possibilities of perpetuating such a low and degenerate race. Remedies of this sort have been tried successfully in Europe and are now meeting with success in this country. (Hunter 1914, p. 263)

A large number of scientists and science books in the 1920s, besides the Hunter textbook *Civic Biology*, also supported eugenics and the racism that it taught. As late as 1951, one of the leading high school biology textbooks uncritically summarized the harm the Kallikak Family had caused to society (Moon et al., 1951, pp. 649–651). This text even reproduced the Kallikak Family chart, never indicating that the study was discredited decades earlier (Moon et al., 1951, pp. 649–651).

Columbia University professor Henry Garrett in his 1955 text, *General Psychology*, also repeated the Kallikak Family story. Included with the Garrett text was a chart which showed that the "bad" Kallikak Family members had produced "hundreds of the lowest types of human beings" and the "good" Kallikak Family had produced "hundreds of the highest types of human beings" (p. 65, Figure 1).

Garrett, the former president of the American Psychological Association, added some details of the "good" Kallikaks (from the "normal Quaker girl"), whose descendants included "governors, college presidents, lawyers, physicians, teachers, and businessmen" (Garrett, 1955, p. 64). Garrett added that it is "highly improbable that inheritance plays only a minor role in the achievement record of a family…it seems equally unlikely that the Kallikaks are products simply of circumstance.…Interbreeding among those less able folks who are left behind is apparently the chief cause for a steady deterioration in the social and economic life of the community" (Garrett, 1955, pp. 64–66).

Furthermore, the clear implication from this chart was that it was the women who carried the so-called "bad genes," not the men. The notion that the dominance of good progeny from the good mother in the one line vs. the dominance of bad progeny from the bad mother in the other line was all due to the mother, not the father, was obviously contrived. This may explain the fact that virtually all persons sterilized for eugenic reasons were women, often Black women (Reilly, 1987, p. 161).

The 1912 *Kallikak Family* study's influence lasted for over a half century after its publication. Between 1907 and 1963, at least 70,000 persons were sterilized in the United States for eugenic reasons, the vast majority being women (Stern, 2020). Thus, the influence of Goddard's "immensely popular" book, *The Kallikak Family*, was enormous and did much to rationalize the acceptance of the negative eugenics' belief (Smith, 1985; Durst, 2017). Negative eugenics was the branch of eugenics that focused on sterilizing persons who were believed to be carriers of genes for feeble-mindedness (Reilly, 1987, p. 154). Positive eugenics focused on encouraging persons judged as having "good genes," to have large families (Reilly, 1987, p. 154).

When the many flaws of the Kallikak study were first brought to Goddard's attention, he wrote to Elizabeth Kite for her explanation. After she was unable to explain the damaging problems encountered in the study, Goddard eventually realized that the research was almost entirely fabricated, and not only useless, but harmful (Dunlap, 1940). Nonetheless, he persisted in supporting its validity. As Smith documented, Goddard was a prejudiced charlatan with little thought except for his own fame (Smith and Wehmeyer, 2012).

His major rewriting of the Kallikak Family's history went so far as to distort or deface family pictures to make the subjects look feeble-minded (Smith, 2012). The entire Kallikak study turned out to be another colossal hoax, just as was Piltdown Man. Only after Goddard retired from teaching at Ohio State University did he cease attempting to defend his lifelong study. Nevertheless, in the end, the effects of the study on the American and German societies had been catastrophic (Cole, 1951, pp. 461–471).

Even though the Kallikak Study claims were debunked in the late 1920s, the Kallikak myth persisted for decades. As late as the 1940s, UCLA professor Knight Dunlap called the Kallikak Family and similar studies

"appalling legends" that persisted in textbooks published as late as 1940 (Dunlap, 1940, p. 221). With the recent sequencing of the entire human genome, and the specter of using eugenics again, the Goddard eugenics study is a horrific reminder of how social attitudes affect science.

The Supreme Court Approves Eugenics

In the 20th century, Darwinian eugenics was supported by a large number of scientists and doctors (Lifton, 1986; Cornwell, 2003). When the Nazis came to power in 1933, fully 51 percent of the Nazi Party members were from the professional classes, especially teachers. Teachers were required to take an oath of "absolute fidelity to Adolf Hitler" (Hicks, 2010, p. 32). The movement in America faced opposition primarily from Black and White churches and persons who believed that all men were created in the image of God.

To silence this opposition, the eugenicists brought a case all the way to the Supreme Court. The Court sided with the eugenicists, ruling that an uneducated White girl, Carrie Buck, could be sterilized against her will. The highly respected Supreme Court Justice, Oliver Wendell Holmes, sanctioned state-enforced sterilization of so-called "inferior persons" based on Darwinian eugenics, claiming that,

> heredity plays an important part in the transmission of insanity, imbecility…it is better for all the world, if instead of waiting to execute degenerate offspring for crime, or to let them starve for their imbecility, society can prevent those who are manifestly unfit from continuing their kind. The principle that sustains compulsory vaccination is broad enough to cover cutting the fallopian tubes. Three generations of imbeciles are enough. (*Buck v. Bell*, 1927, pp. 206–207)

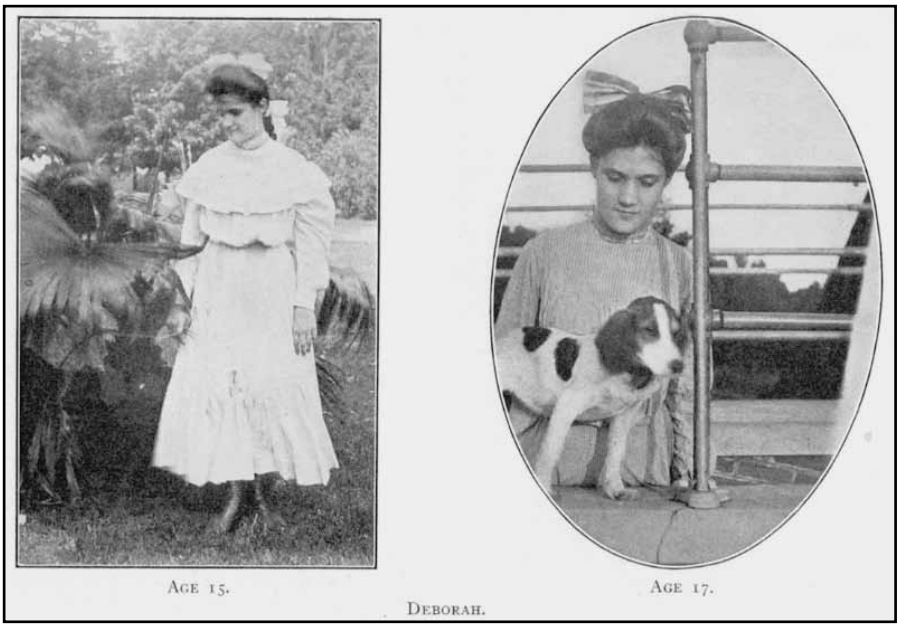

Figure 5. Deborah, at ages 15 and 17, displaying her sewing talents and love of animals. From Goddard, H. 1912. *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. Macmillan Publishers, New York, NY.

The 1927, 8-to-1 Supreme Court decision opened the eugenic floodgates, soon resulting in over 70,000 eugenic sterilizations in America alone and thousands in other countries (Cohen, 2016). These thousands of people the courts deemed unfit to reproduce due to their "evolutionary and mental inferiority." The victim, Carrie Buck, mentioned above, ended up in an institution only because she was a young, pregnant girl without a family member willing to take her in. Furthermore, in contrast to the Justice's claim, Carrie was a lifelong avid reader. And those who found themselves against her in a bridge game had no reason whatsoever to believe that she was "feeble-minded" or anything even close (Cohen, 2016).

This Supreme Court ruling also influenced the Nazis to copy the American law, forcibly sterilizing 375,000 putatively "inferior" Germans. At the Nuremberg War Crime trials, the Nazis who carried out forced eugenic sterilizations cited the *Buck v. Bell* case as their motivation, and also as their defense (Roland, 2010).

Why the Kallikak Family Myth Was Widely Accepted

Scientists almost unanimously supported eugenics; the Hunter textbook was only one example. At the very least, they did not speak out against it from Darwin's day until about the time the Civil Rights Movement commenced—a span lasting for the better part of a century. *The Human Betterment Foundation*, supported by millionaire Ezra Gosney, financed thousands of eugenic pamphlets that were mailed to college professors across the nation. He also sponsored a column on eugenics in *The Los Angeles Times* and underwrote hundreds of college lectures preaching the importance of eugenics in improving the nation's health (Reilly, 1987, p. 160).

Only a few scientists at this time published research against eugenics

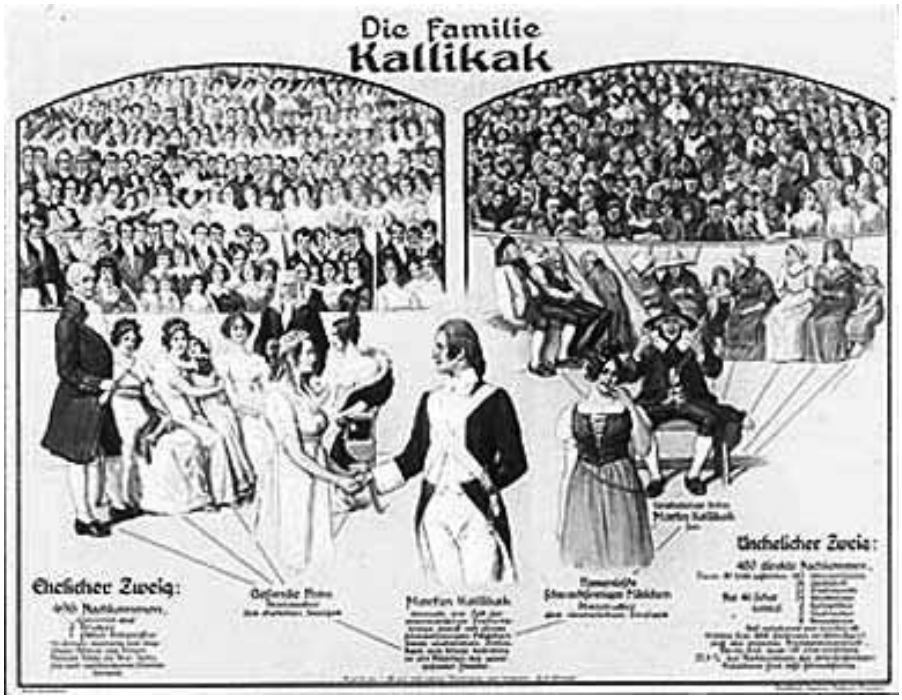

Figure 6. A German educational slide illustrating the importance of eugenics. The left side is the "good" family that turned out well; the right side is the "bad" family that turned out very poorly. From the DNA Learning Center. https://dnalc.cshl.edu/view/15767-German-educational-slide-explaining-the-Kallikak-family-1924.html.


A PUPIL WHO CAN NEITHER READ NOR WRITE, BUT WHO PAYS HER WAY BY USEFUL WORK
(She is a waitress in the school dining-room, does beautiful woodwork, and plays the cornet in the band)

Figure 7 . Deborah as an attractive young lady. Note the description below the picture claiming she can neither read nor write. From Dunlap, K. 1940. Antidotes for superstitions concerning human heredity. *The Scientific Monthly* 51(3): 221–225, p. 221.

and racism. The most well-known examples were Franz Boas and Ashley Montague. In contrast, the Scopes Trial expert witnesses *never once* distanced themselves from the many inflammatory racist passages in the textbook *Civic Biology* at the center of the Scopes case (Bergman, 2023). Some of those who testified in the Scopes Trial were active supporters of the eugenics movement (Pavuk, 2018). Even after the abuses of the Nazi's Darwinian eugenics were exposed in the 1940s, some academics still approved the eugenic passages in this once widely used public high school biology textbook.

The Kallikak Family Story Migrates to Germany

The Kallikak Family story had an enormous influence on the eugenics movement, not only in America, but also in Nazi Germany. Hitler learned about the Kallikak Family study when he was imprisoned in 1924 for his part in the Nazi's attempt to overthrow the government. One book he read in prison was "the second edition of the first great major German eugenic text, *Foundation of Human Heredity and Racial Hygiene*….which had been published in 1921" (Black, 2003, p. 270).

The widely used college text was written by three leading German academics. Professor Bauer wrote in the text that the "American investigator H.H. Goddard concluded that at least two-thirds of all cases of feeble-mindedness are hereditarily determined. This estimate harmonizes with our own experience in Germany.…In the Kallikak family described by Goddard, the offspring of 40 marriages in which both the parents were imbeciles numbered 222, and of these, 220 were feeble-minded and 2 apparently normal" (Bauer et al., 1931, pp. 428–429). Bauer also wrongly concluded that feeble-mindedness was caused by a dominant gene. Bauer then reviewed several other studies similar to the Kallikak Family study, noting that they supported many of the same results as Goddard's study.

Hitler was very impressed with Goddard's research. The year Hitler assumed power in Germany, 1933, a new German language edition of *The Kallikak Family*, translated by Karl Wilker, was published. (Figure 6 is one illustration used to introduce Germans to the significance of the

Kallikak study.) In his introduction, Wilker made it clear how important *The Kallikak Family* research was in Nazi Germany's adoption of eugenic programs (Zimmer, 2018, p. 94). The Nazis even used the book's conclusions as a teaching tool for German scientists. One example is the 1935 film titled *Das Erbe* (*The Inheritance*) which was heartily endorsed by Hitler. The Nazi government, in a program called T4, eventually murdered over 200,000 persons that they judged were feeble-minded souls having lives not worth living (Gerstein, 2017).

Summary

The Goddard account was promoted as a very important study consisting of one family's genealogy which showed the harm caused by allowing persons with inferior genes to have children. This study played a major role in the sterilization of 70,000 persons in the United States and thousands in the other nations which accepted eugenics. In 1914, Karl Wilker translated *The Kallikak Family* study into German. Wilker praised Goddard's work and noted that it had influenced the passage of laws that supported involuntary sterilization of feeble-minded persons in Germany during the Nazi regime (Dennert, 2021). It was also very important in the sterilization, and later the deaths, of millions of Germans.

As historian Leila Zenderland documents, Goddard's study is another example of how science can go very wrong. *The Kallikak Family* study illustrates how scientists can allow personal biases and prejudices to wrongly influence their scientific research (Zenderland, 1998). So influential, but yet recognizably fallible, was Goddard's study that Stephen J. Gould called *The Kallikak Family* account the "primal myth of the eugenics movement" (Gould, 1981, p. 198). In the end the study was "science falsely so-called" (1 Timothy 6:20). As Smith concluded, the Kallikak study, and others like it, resulted in a gross injustice, denying victims the dignity afforded to them simply by their status as human beings (Smith, 2012, p. 215). In short, the book on the Kallikak Family,

> Like most books in the genre, [as a]…pseudoscientific treatise described generations of illiterate, poor, and purportedly immoral, Kallikak family members who were chronically unemployed, as supposedly feeble-minded, criminals, and, in general, perceived as threats to *racial hygiene*. (Smith and Wehmeyer, 2012a)

Goddard's research was only foiled by scientists who were brave enough to stand up against "science falsely so-called." Nothing will change in society, in science, or in our world, if those who know the Truth do not stand up and boldly, with confidence and careful research, proclaim truth—only *known* Truth will set us free (John 8:32). Scripture teaches and confirms that each one of us was made in the image of God, which gives each of us incredible worth and value. Readers can learn from the past and not judge people, labeling them feeble-minded, a label often given to those who have not had the educational or social opportunities as those labeled non-feeble-minded.

References

Aubert-Marsonm, D. 2009. Sir Francis Galton: The father of eugenics. *Medical Science* (Paris) 25(6–7):641–645. [Article in French.]

Bergman, J. 2004. Darwinism and the teaching of racism and eugenics in biology textbooks. *Technical Journal* 18(1).

Bergman, J. 2023. *The Other Side of the Scopes Trial*. Wipf & Stock Publishers, Eugene, OR.

Bjorkman, F. 1911. An experimental station in race improvement. *The American Review of Reviews* 44:327–333.

Black, E. 2003. *War Against the Weak: Eugenics and America's Campaign to Create a Master Race*. Four Walls Eight Windows, New York, NY.

Buck v. Bell, 274 U.S. 200. 1927. Library of Congress, Washington, D.C.

Cohen, A. 2016. *Imbeciles: The Supreme Court, American Eugenics, and the Sterilization of Carrie Buck*. Penguin Books, New York, NY.

Cole, L.E. 1939. *General Psychology*. McGraw Hill, New York, NY.

Cole, L.E. 1951. Metapsychology and the right to believe. *American Journal of Orthopsychiatry* 21(3):461–471.

Cornwell, J. 2003. *Hitler's Scientists: Science, War, and the Devil's Pact*. Viking Press, New York, NY.

Dennert, J.W. 2021. The Kallikak Family: A study in the heredity of feeblemindedness (1912) by Henry Herbert Goddard. *Embryo Project Encyclopedia*, July 30. ISSN: 1940–5030.

Dunlap, K. 1940. Antidotes for superstitions concerning human heredity. *The Scientific Monthly* 51(3):221–225.

Durst, D. 2017. *Eugenics and Protestant Social Reform*. Wipf and Stock Publishers, Eugene, OR.

Garrett, H. 1955. *General Psychology*. American Book Company, New York, NY.

Gerstein, K. 2017. *The Nazi Slaughter of the Disabled: The Euthanasia Program T4*. American Bibliographic Press, New York, NY.

Gillham, N. 2001. Sir Francis Galton and the birth of eugenics. *Annual Review of Genetics* 35:83–101. doi: 10.1146/annurev.genet.35.102401.090055.

Goddard, H.H. 1912. *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. Macmillan Publishers, New York, NY.

Gould, S.J. 1991. *Bully for Brontosaurus*. W.W. Norton & Company, New York, NY.

Hicks, S. 2010. *Nietzsche and the Nazis*. Ockham's Razor Publishing, Chicago, IL.

Hunter, G.W. 1914. *A Civic Biology: Presented in Problems*. American Book Company, New York, NY.

Jackson, E. 2017. A Catchy Phrase, But Is It True? https://www.nybg.org/blogs/science-talk/2017/02/a-catchy-phrase-but-is-it-true/.

Larson, E.J. 1997. *Summer for the Gods: The Scopes Trial and America's Continuing Debate Over Science and Religion*. Basic Books, New York, NY.

Lifton, R. 1986. *The Nazi Doctors: Medical Killing and the Psychology of Genocide*. Basic Books, New York, NY.

Moon, T., P. Mann, and J. Otto. 1951. *Modern Biology*. Henry Holy and Company, New York, NY.

Pavuk, A. 2018. The American Association for the Advancement of Science committee on evolution and the Scopes Trial: Race, eugenics and public science in the U.S.A. *Historical Research* 91(251):137–159.

Reeves, H.T. 1938. The later years of a noted mental defective. *American Journal on Mental Deficiency* 43:194–200.

Reilly, P. 1987. Involuntary sterilization in the United States: A surgical solution. *The Quarterly Review of Biology* 62(2):153–170.

Roland, P. 2010. *The Nuremberg Trials: The Nazis and Their Crimes Against Humanity*. Chartwell Books, New York, NY.

Samaan, A.E. 2020. *From a "Race of Masters" to a "Master Race."* Library Without Walls, Knoxville, TN.

Smith, J.D. 1985. *Mind's Made Feeble: The Myth and Legacy of the Kallikaks*. Aspen Systems Corporation, Rockville, MD.

Smith, J.D., and M. Wehmeyer. 2012. *Good Blood, Bad Blood: Science, Nature and the Myth of the Kallikaks*. AAIDD, Washington, D.C.

Smith, J.D., and M.L. Wehmeyer. 2012a. Who Was Deborah Kallikak? *Intellectual and Developmental Disabilities* 50(2):169–178.

Stern, A. 2020. Forced sterilization policies in the U.S. targeted minorities and those with disabilities—and lasted into the 21st century. Institute for Healthcare Policy and Innovation. https://ihpi.umich.edu/news/forced-sterilization-policies-us-targeted-minorities-and-those-disabilities-and-lasted-21st.

Zenderland, L. 1998. *Measuring Minds: Henry Herbert Goddard and the Origins of American Intelligence Testing.* Cambridge University Press, Cambridge, UK.

Zimmer, C. 2018. *She Has Her Mother's Laugh: The Powers, Perversions, and Potential of Heredity*. E.P. Dutton, New York, NY.

Groundwork for Creation Cosmology

Part II: Working Assumptions

Andrew Repp*

Key Words: cosmology, inexplicability, intelligibility, mature creation, quasi-steady state, timescales

* Ph.D., mathematics; Ph.D., astronomy
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Abstract

Today's extensive cosmological data sets are a gracious gift of God, inviting us to understand them within a Biblical framework. A previous article (Part I) considered several relevant Scripture passages. This article attempts, in turn, to justify three working assumptions: firstly, that God designed the Universe to be intelligible, given sufficient observational and theoretical perseverance; secondly, that God designed it to maintain roughly invariant characteristics over long periods of time (quasi-steady state); thirdly, that certain features of the Universe are ultimately inexplicable in terms of today's physics.

Simple Summary

This article, "Groundwork for Creation Cosmology—Part II: Working Assumptions," by Andrew Repp, lays out three key ideas to help interpret today's extensive cosmological data within a Biblical framework. First, it assumes the Universe is intelligible, meaning God designed it in a way that we can understand through careful observation and study, reflecting His wisdom and consistency. Second, the author proposes the Universe exists in a quasi-steady state, similar to a mature forest where individual plants grow and die, but the forest as a whole maintains consistent characteristics over long periods. This idea suggests that many astronomical processes which appear to take billions of years ("process time") could have been accomplished rapidly during Creation Week, allowing for an intelligible and diverse Universe from the start. Third, the article argues that certain features of the Universe are ultimately inexplicable by today's physics, such as its initial creation from nothing (creation *ex nihilo*), its remarkable design, and the accelerated rates during Creation Week. These assumptions provide a framework for creation scientists to study the cosmos and integrate its observations with Scripture.

Introduction

Yesterday's cosmologists could only dream of the data available today. These include cosmic microwave background measurements accurate to about 2 parts per million, at a resolution of ten arcminutes (Planck Collaboration et al., 2011, 2020), as well as galaxy surveys (e.g., Sloan Digital Sky Survey: see Eisenstein et al., 2005; Dawson et al., 2013) and weak lensing surveys (e.g., Dark Energy Survey: see Amon et al., 2022; Secco et al., 2022).

To take "every thought captive to obey Christ" (2 Corinthians 10:5b), we must interpret these data in light of a straightforward reading of Scripture. The task is immense and constitutes an area of weakness in young-Earth creationism (see discussion in Repp, 2022a). A planned series of three papers hopes to lay the groundwork for such integration. The first (Repp 2024, hereafter Paper I) considers Hebrews 11:1–3; 2 Peter 3:5–7; and Romans 8:18–23. It concludes that, unless we explicitly include miraculous (supra-providential) action in our models, we will inevitably stray on the subject of origins; that we should limit such action to what Scripture requires; and that in cosmology we can restrict such action to Creation Week.

This paper, the second, attempts to justify the following three working assumptions: the intelligibility of the Universe, its quasi-steady state character, and the ultimate inexplicability of creation. A planned third paper will survey relevant observational data.

Intelligibility

Our first working assumption is that the Universe is intelligible, given

sufficiently detailed observation and analysis. Positively, it postulates that data for an accurate (not exhaustive) understanding of the Universe is, in principle, accessible, though not necessarily in hand.[1] Negatively, it postulates that the Universe is not conspiring to lead us to false conclusions. (By a similar assumption, creation geologists understand fossils to be the result of actual events, not *in situ* creations.)

This assumption is, in fact, required for *any* inference from astronomical observations. Just as we can observe a fossil and deduce information about its burial, we submit that one should likewise be able to deduce, from astronomical observations, information about events that have taken place (or are taking place) in the Universe. The following four lines of reasoning support this assumption.

A Priori Reasons

Firstly, the character of God—specifically His wisdom (rationality) and faithfulness (consistency)—leads us to expect intelligibility from the Universe. His wisdom ensures that no aspect of His work is capricious, and His faithfulness ensures that it is self-consistent and "true"—i.e., though our deductions may be mistaken, we are *not* mistaken to assume the legitimacy of deduction itself. Biblical support is manifold: personified Wisdom was the master Workman in creation (Proverbs 8:22–31); God by understanding established the heavens (Proverbs 3:19); and He establishes His faithfulness in the heavens themselves (Psalm 89:2). The One by whom "all things were made" is the Logos, rationality Himself (John 1:1–2), the Wisdom of God (1 Corinthians 1:30).

In addition, since God's work of providence is intelligible—amenable even to mathematical formulation[2]—one can expect the same from His work of creation, for the same Word which created (Hebrews 1:2) now upholds and sustains (Colossians 1:15–17; Hebrews 1:3). We are not punctuated deists—as if God maintained a hands-off policy apart from occasional miracles. He is always at work (John 5:17) in even the most random-seeming events (Proverbs 16:33). Though creation is not repeatable, having ceased on Day 7 (Genesis 2:2–3), there is a unity between creation and providence, though it is Personal, not mechanical. In addition, the image of God (Genesis 1:26–27; 9:6; James 3:9) is what allows us to comprehend the wisdom of creation. Thus God's character renders the Universe rational, and the *imago Dei* renders it intelligible to *us*.

A second reason to expect intelligibility is that the heavens *declare* God's glory (Psalm 19:1–2). Romans 1:20 teaches that creation (including the heavens) causes God's "invisible attributes, namely, His eternal power and divine nature" to be "clearly perceived" by all. Thus, we can expect a detailed study of the Universe to reveal His wisdom and faithfulness ever more clearly. Considering the stars in particular, their designated purpose of serving "for signs" (Genesis 1:14) seems to require at least some intelligibility. Further, because the works of the Lord are great, they are "studied by all who delight in them" (Psalm 111:2)—and study of the unintelligible ends quickly in frustration.

Mankind's primeval mandate (Genesis 1:28; Psalm 8:6–8) provides a third reason to expect intelligibility, given that God gave humanity (in the person of Adam) responsibility for the biosphere. The wording of Psalm 8:6 suggests that mankind would eventually exercise dominion over the entire Universe ("all things," cf. also the analysis in Paper I)—and we know that redeemed humanity will do so in the Person of Christ Jesus (the Last Adam). Universal dominion implies the capacity to make sense of the Universe. Even the biosphere is affected by heavenly events, most obviously in the link between tides and seasons and the lives of various organisms. The ability to understand these cycles would be necessary to properly exercise dominion.

The Experience of Science

The arguments above make intelligibility plausible, but they are not conclusive. The wisdom of God in framing the Universe might far surpass our capacity. The heavens might display God's wisdom by *being* incomprehensible, demonstrating the height of God's thoughts above ours (Isaiah 55:9). The stars could serve as signs by simply remaining in place for navigation and timekeeping. And detailed knowledge of astrophysics is not necessary for intelligent supervision of the biosphere.

Thus, we must also consider the experience of science itself, whereby careful observation has consistently revealed regularities in nature—laws which express the wisdom, power, and faithfulness of God. These laws exist because His rationality guides His action in mathematically regular ways; because His sovereign power permits not one deviation from His decree (Daniel 4:35); and because His faithfulness includes "no variation or shadow due to change" (James 1:17).

1 Obtaining and interpreting such data might require technological and theoretical advances. Furthermore, as Paper I argues, these data points and/or sets must include the statements of Scripture.

2 One could define science as the branch of knowledge describing the laws laid down by Christ as He upholds the Universe.

These attributes led early investigators to *expect* intelligibility from the natural world, which did not disappoint. In biology, chemistry, and physics—careful, painstaking study has yielded ever-greater understanding of the underlying structure and laws. Why would we expect astronomy (and cosmology in particular) to be any different?

As Jaki (1986) writes, the Christian worldview—with its expectation of intelligibility—was the historical foundation for the rise of modern science:

> The scientific quest found fertile soil only when this faith in a personal, rational Creator had truly permeated a whole culture, beginning with the centuries of the High Middle Ages. It was that faith which provided, in sufficient measure, confidence in the rationality of the universe, trust in progress, and appreciation of the quantitative method, all indispensable ingredients of the scientific quest. (p. viii)

The fact that we have successfully sent probes to all major solar system bodies demonstrates the intelligibility of its operation. Further afield, we can deduce much information from the light curves of eclipsing binaries (e.g., Samec et al., 2022), and we can identify most spectral lines of distant stars. Do we expect cosmology to differ from the rest of astronomy? And if it *does* differ, where should we draw the line, cease deduction, and retreat to mystery? Of course, our data set must always include Scripture (normative over all); we must also remember that many Creation-Week processes ceased on Day 7. But the character of God led early scientists to expect intelligibility from the natural world (given careful, humble, persevering observation)—and subsequent experience has abundantly rewarded that expectation. Would it not then be faithless now to retreat from that confidence?

Implications

To summarize, this working assumption postulates that even if we do not yet possess it, the data for an accurate understanding of the cosmos is in principle accessible (though it might require theoretical and technological development). It also implies that the Universe does not embody a sort of conspiracy to lead us to false conclusions.

Readers might wonder why so much time has been spent on a point many will regard as self-evident; among other reasons, this working assumption provides guardrails for our cosmological modeling. In particular, under this assumption, we can expect the following:

- Dedicated investigation will uncover real, true properties of the Universe—whether the operation of stars, the process of gravitational collapse, the nature of dark matter, etc. More fundamentally, it also presupposes that our observations are "real"—that is, they reveal true information about an objectively existing external world—and that God's Word gives us sufficient context to correctly understand this data (see Paper I).
- In particular, patterns tell us something. Whether main sequence turnoffs (Faulkner and DeYoung, 1991), Hubble's Law, or the mass-metallicity relation (Tremonti et al., 2004)—the patterns we observe point to something deeper, just as in chemistry or physics. The "something deeper" might be scientific or (possibly) theological. But if the Universe is intelligible, we may not simply ignore these patterns.[3]

Relinquishing this assumption would require abandonment not only of creationary cosmology but also (if we are consistent) of science itself.

Quasi-Steady State

The second working assumption is that God designed the Universe to operate in a quasi-steady state. This phrase does not here denote the cosmological theory of that name (Hoyle et al., 1993).[4] Rather, it states that the Universe was designed to exhibit essentially the same characteristics over vast (but not infinite) periods of time.

A mature forest biome provides a good analogy. The individual plants within this community change on a variety of timescales. Some will grow and die in a matter of years, while others last centuries. But multiple self-renewal processes maintain roughly the same proportion of flowering shrubs to trees, as new growth replaces dying plants. Over time, the forest, viewed as a whole, retains the same characteristics, presenting essentially the same look for millennia; thus, we could say it is in a "steady state." The state is not in fact perfectly steady, since over millennia the soil depth would presumably increase, etc. Thus, we should say rather that the forest is in a *quasi*-steady state.

Likewise, this working assumption proposes that the Universe was designed to present essentially the same look over vast periods of time.[5] Again, this would not be a true steady state, for as stars fuse hydrogen into helium—

3 For in-transit-creation models, for instance, this assumption implies that information encoded into the proposed virtual history (regarding, e.g., stellar development) gives us true insight into the operation of those processes in today's (non-virtual) Universe.

4 A reincarnation of the old steady-state cosmology, which blatantly violates both Scripture and energy conservation.

5 This would have been the original design. Scripture reveals that both the Earth and the heavens will need to be renewed because of sin (2 Peter 3:10–13).

and helium into heavier elements—the amount of helium (and metals) in the Universe increases; likewise, by the Second Law of Thermodynamics, entropy increases. Thus, we term this condition a *quasi*-steady state.

At least three lines of reasoning support this working assumption.

(Originally) Designed Timescale of Universe

Many astronomical processes involve vast timescales. Sometimes they are the result of great distances. If two galaxies are 50,000 light years across and approach each other at 150 km/s, simple mathematics sets the timescale for their merger—in this case, at least 100 million years.[6] Other timescales are set by the rate at which stars produce energy. The Sun radiates with a power of 3.8×10^{26} watts; to generate this power, it must fuse roughly 600 billion kg of hydrogen into helium each second. Hence, if the core of the Sun (where fusion occurs) consisted of pure hydrogen with a mass of 6×10^{29} kg, the Sun would have enough fuel to last over 30 billion years.[7] Thus, even without an evolutionary bias toward long ages, basic mathematics—the same mathematics by which we calculate how long a trip will take or a fire can burn—demonstrates that the natural timescales for astronomical processes can reach billions of years.

However, while these timescales are vast compared to the current human lifespan, they are *not* vast compared to man's original lifespan. Man was created to be immortal, for human death came by sin (Romans 5:12). It should therefore not surprise us to find that the Universe was designed to last—and the Earth to be habitable—for millions or possibly billions of years.[8] Hence, the fact that the Universe was designed to house a community of immortal beings makes sense of the immense astronomical timescales and suggests that the Universe was created in a quasi-steady state, with built-in self-renewal processes to sustain it for vast periods of time.

Designed to Display Glory

Secondly, Scripture teaches that the Universe was created to bring glory to God (Psalm 19:1; Colossians 1:6; Revelation 4:11), and one God-glorifying feature of a quasi-steady state Universe is its diversity. A mature forest contains both saplings and full-grown trees, which display God's glory in different ways. Likewise, a quasi-steady state Universe would contain stars with many different (apparent) ages, thus better displaying God's multifaceted glory. An unfallen Adam and Eve would not need to wait millions of years to witness the power of a supernova, nor tens of millions of years to see the beauty of a planetary nebula.

Designed to be Intelligible

Thirdly, and perhaps most significantly, a quasi-steady state Universe is more intelligible (see above) than the alternative. Even immortal humans would live within the rhythms of our own planet—days, months, and years. Stars' composition—and thus their characteristics—change as they fuse hydrogen into helium, helium into carbon, etc.—but without a steady state Universe, Adam would have had to wait billions of years to observe these changes. In the real Universe, even fallen man with his fleeting lifespan can see stars in all stages of development, allowing us to compare our observations with predictions. In the same way, by observing a mature forest (with trees in different stages of growth), one could piece together a reasonably accurate picture of the life of a tree, even without waiting for any one tree to go through the whole process.

Likewise, a quasi-steady state Universe allows us to use it as a vast physics lab, where we can observe "experiments" running on time-, distance-, and energy-scales utterly inaccessible on Earth. And yet because so many of these experiments are running simultaneously, at so many stages of completion, we can observe and make sense of the results.

Mature Creation

We noted above that a mature forest exists in a quasi-steady state, in which individual plants change but the population does not. This is a consequence of maturity; an open field *would* change,[9] giving rise to shrubs and then conifers. Only in the climax community does it reach a quasi-steady state. Likewise, the cells of Adam's body would (like ours) presumably have been replaced over time, but he himself would not substantially age. Once again, this steady state is a result of maturity; children *do* exhibit change as they grow, until they reach adulthood. In the same way, one can view a mature creation as a means to the quasi-steady state end. On Day 7, God *finished* and rested from His work; nothing else was necessary for completion, and since that time His work of providence has

6 It is in fact expected to take much longer, because a merger requires several passes before completion.

7 Its main sequence lifetime is expected to be about a third of this, since the core is not believed to be pure hydrogen.

8 Note that Zhivkov and Tounchev (2022) demonstrate the long-term ($\gtrsim 10^5$ years) stability of the Solar System; they also discuss the possibility of extending the proof to 10^6 or 10^9 years.

9 Assuming appropriate climate conditions.

been one of *upholding* and *maintaining* (Colossians 1:17; Hebrews 1:3). It was intelligible to His image-bearers, it displayed His manifold glory, and it was an appropriate home for beings designed to live forever.

Implications

If this working assumption is correct—and it seems to fit what we observe—then we are like mayflies in Eden.[10] Intelligent mayflies (with correspondingly fast thought processes) could conceivably take snapshots of trees in various stages of development and piece together the life cycle of a tree. By observing cellular division (and keeping careful records) they might be able to estimate how long it would take for a tree to grow from seedling to maturity. Accordingly, they could deduce that the trees they observe had experienced centuries of growth, and they might thus deduce a correspondingly large age for the garden.

Their conclusion about the *process* would be correct. According to Genesis 2:9, "Out of the ground the Lord God made to spring up every tree that is pleasant to the sight and good for food." Since the trees did not pop into existence fully formed but grew up from the ground, the mayflies' deduction of a tree-growth process would be right. But the age they obtain would be hopelessly wrong, if they did not believe that God had accomplished all of this work in one day.

In the same way, the assumption of naturalism—which willingly ignores God's creative work (2 Peter 3:5)—inevitably errs regarding the age of the Earth and Universe. However, if our first two working assumptions are correct, then the processes we infer from our "snapshot" observations are presumably accurate.

This idea—many years' worth of processes occurring in the heavens during Creation Week—is no novelty. For instance, Samec (2016) writes,

> The conclusion of this study is that the observable events in the cosmos outside of the solar system really did happen and are therefore objects of scientific study for the creation scientist. Phenomena were not just created with appearance of age. The events are as follows: The stars were created, and perhaps many coalesced from clouds of gas and lived out their lives, and are living out their lives. Normal solar-type stars went through their nuclear burning cycles…became semidetached, and then contact binaries that we presently observe. Their abundance conveys a message that should be heeded by the creation community.

Humphreys (2017) also suggests that millions—or even hundreds of millions—of years could have occurred in distant galaxies during a short period of Creation Week.

The RATE team (Radioisotopes and the Age of The Earth, Vardiman et al., 2005) reached similar conclusions in a different field. They noted evidence that billions of years of *processes* (radiometric decay) have indeed taken place, but that these processes occupied only a short period of time—i.e., the process inferred by standard science is essentially correct, but not the amount of time. As part of the same project, Baumgardner (2000) also notes the possibility of accelerated geomorphological processes during Creation:

> This implies a major aspect of the Earth's formation involved the cycling of a major fraction of the mantle through a partial melting process near the planet's surface to produce the continental crust with its high concentrations of incompatible elements….If such processes unfolded in a brief period of time as the account in Genesis 1 indicates, then this also places constraints on the nuclear decay histories of the radioactive elements. (p. 80)

It is thus helpful to distinguish two measures of time and/or age. The first is *process time*; rather than measuring time directly, it quantifies the amount of a given process that has occurred and uses current rates to convert to time. The second measure we call *elapsed time*, which is the true amount of time occurring on Earth.

For instance, as measured by certain types of radioactive decay, over four billion years of process time have occurred in some terrestrial rocks,[11] but the elapsed time would be measured in days. A distinction between these time measures almost necessitates supernatural intervention; thus, we expect such a distinction (on any large scale) only during Creation Week and the Flood Year (see analysis in Paper I).

There is no reason to restrict this distinction to geology. The process age of a globular cluster could be billions of years when measured by stellar development; the elapsed age would be five orders of magnitude less, as measured by the actual passage of time on Earth. Thus, this distinction resolves the tension in creationary discussion of stellar development.[12] As Faulkner and DeYoung (1991) note, the physics behind the standard the-

10 For the sake of illustration, we assume that mayflies are not *nephesh* life and would have died as quickly in Eden as they do today (after the Genesis 3 Curse).

11 Austin (2005) notes that for terrestrial rocks the amount of process time depends on the element studied. The results of Snelling (2014a,b,c, 2015a,b) seem to indicate this is not the case for meteorites.

12 This article uses the phrase "stellar development" rather than the more standard "stellar evolution," given that the changes occurring in stars have little in common with Darwinism.

ory of stellar development is, for the most part, well-understood; however, the timescale for this development at first appears to be in tension with a young Universe. If we understand that, during Creation Week, process time need not correspond to elapsed time—and that God used accelerated development to create a quasi-steady state Universe—then the tension disappears.

Ultimate Inexplicability

However, even when we assume an intelligible, quasi-steady state Universe—and thus make every allowance for accelerated Creation-Week processes—the Bible indicates that the work of creation is ultimately inexplicable. Since God ceased this work on Day 7, deductions from currently-observed phenomena will inevitably mislead us when we consider origins (Hebrews 11:1–3). God's ways are, in the end, inscrutable (Romans 11:33–34).

Biology provides a helpful analogy. Living organisms incorporate many adaptive mechanisms; some of them act quickly (e.g., the response of the pupil to light), but others act across generations (Tomkins et al., 2022; cf. Continuous Environmental Tracking, Guliuzza, 2013). The latter explains much of the observed speciation and, in some cases, may be responsible for taxa up to the family level. However, there are deep and wide discontinuities between the higher taxa, both in the fossil record (e.g., Bergman, 2007) and today (e.g., Frair, 2000); these discontinuities are not explicable in terms of current-day speciation processes. Scripture indicates that God did *not* use any such process to produce created kinds or, for that matter, to produce life from non-life. Instead, "he spoke, and it came to be; he commanded, and it stood firm" (Psalm 33:9).

Likewise, while we can expect many cosmological observations to be explicable in terms of today's physics, we also expect there will come a point—or points—at which it will fail us. If we do not explicitly allow for God's supernatural work, we will encounter apparent causal discontinuities,[13] things which today's physics cannot explain.

Creation *Ex Nihilo*

The most obvious such discontinuity is creation *ex nihilo*, the existence of something rather than nothing. Conservation of energy is a stubborn fact, and modern cosmology is (begrudgingly) rendering an eternal Universe increasingly untenable. Though the Big Bang model is not Biblical, it is too uncomfortably close for many secularists ("like a bad dream," Jastrow, 1978, p. 116). Attempts to explain the origin of the Universe naturalistically typically depend on speculation and ambiguity (e.g., redefining "nothing"; cf. analysis in Repp, 2022b). The fact is, the coming into being of our Universe is inexplicable in terms of present-day processes. This is surely the greatest and most fundamental discontinuity exposed by the study of the cosmos.

Design

Design represents a second discontinuity. Just as the design of living organisms is naturalistically inexplicable (e.g., Dembski, 2002), the fine-tuning of the cosmos defies naturalistic explanation. For instance, to produce today's Universe, naturalistic theories require initial conditions with almost the lowest possible entropy (i.e., a very nearly—but not quite—uniform configuration). Since we cannot appeal to infinite time, the probability of this state having arisen by chance is vanishingly small, estimated at less than 1 in $10^{10^{124}}$ (Penrose, 2010, p. 127). A number this tiny effectively falsifies any hypothesis that such fine-tuning arose via present-day physical laws. And yet this low entropy is but one example of fine-tuning; Lewis and Barnes (2016) list many more. Hence, the design evident in the fine-tuning of the Universe is a second causal discontinuity revealed by cosmology.

Rates and Timescales

The first two discontinuities—the existence of and design in the Universe—powerfully and ineluctably point to its Creator. Mankind in his rebellion must suppress this evidence, rendering us "without excuse" (Romans 1:18–20).

However, another set of discontinuities becomes evident when we interpret our observations in light of Genesis 1—namely, the distinction (see above) between process time and elapsed time. For the Universe to exist in an intelligible and quasi-steady state, eons' worth of processes seem to have taken place, whereas a straightforward reading of Genesis indicates that they occurred in a matter of days.[14] Thus, we have a third set of discontinuities: based on Scripture (Hebrews 11:1–3), we understand that many rates and timescales during Creation Week were vastly different than today—and that this difference is due not to any physical cause but to God's will acting through His Word.

13 "Apparent," because they are discontinuous only in terms of today's processes; their true cause is God's supra-providential action.

14 It is possible that some of these processes only *appear* to have occurred, as when Jesus turned water into wine; however, Genesis 2:9 describes at least one clear case of actual process-acceleration relative to current rates.

Other Possible Discontinuities

Are other cosmological observations inexplicable in terms of today's physics?

Here we must beware: it is always dangerous to make apologetic capital out of incomplete observation and theory (see Repp, 2022a, for some examples). As Samec (2005) notes, many "creationary writings are negative and 'gap finding' in nature. We need to be concentrating more on producing creationary models rather than on identifying gaps in evolution" (p. 72). At worst, gap-finding argumentation devolves into saying that, since we cannot explain something, God must be responsible for it. This is the "God-of-the-gaps" fallacy. It is fallacious because we are not punctuated deists: God is responsible for *all* physical processes, whether natural (providential) or miraculous (supraprovidential). Not only is God-of-the-gaps fallacious, it is unwise: if (as so often happens) a physical explanation emerges, then unbelievers have occasion to blaspheme (2 Samuel 12:14) by pointing to a falsified proof of God's existence. If instead we begin with a robust understanding of providence, discovery of physical explanations will instead provide additional reasons to delight in our Creator's work (Psalm 111:2).

Therefore, the following (incomplete) list of potential discontinuities is tentative. While these observations seem at present to be inexplicable in terms of known physics, it is quite possible that valid explanations will arise. If these phenomena are indeed inexplicable, they point to God's supraprovidential work of creation; if a valid explanation is found, they point to God's ongoing work of providence.

One such possible discontinuity is the formation of the initial generation of stars. According to the standard model, virtually all elements heavier than helium ("metals" in astronomical parlance) were synthesized in stars. Thus, the hypothetical first-generation stars ("Population III") would have been metal-free, containing only hydrogen and helium. But no metal-free stars have been found (noted by Faulkner, 1993). The standard explanation is that the first stars were massive enough to quickly burn their fuel and explode as supernovae, so that none exist today. Theoretical reasons do indicate that such stars would be more massive on average, but there seems to be no compelling reason for them *all* to be so large (Ishiyama et al., 2016; Chandra and Schlaufman, 2021). Thus, the question remains, "Why do we see none of them today?" If there truly are no Population III stars, it would indicate either that there were metals in the early Universe[15] or that the first stars did not form from pre-existing material. Either option seems inexplicable in terms of today's physics.

Another possible discontinuity is the formation of the supermassive black holes (SMBHs) at the centers of galaxies. These black holes can have billions of times the mass of the Sun; given a steady supply of gas, they are responsible for the extreme luminosities of active galactic nuclei like quasars. The most natural way to form a SMBH would be for a massive star in the early Universe to collapse to a black hole, which would then accrete material until reaching its present size.

However, a back-of-the-envelope calculation (the Eddington limit) sets a maximum rate for black hole accretion (e.g., Carroll and Ostlie, 2007, p. 1112); essentially, if the rate is too great, then radiation pressure from the accretion disk pushes material away and throttles down the rate. It in fact seems unlikely that galaxies could supply gas continuously even at the Eddington rate (see discussion in Volonteri, 2012). However, we find quasars at high redshift, showing that some SMBHs already had one to ten billion solar masses, at a time considered less than 1 Gyr after the Big Bang. This discovery is "by far the greatest challenge to any theory of SMBH formation" (Woods et al., 2019, p. 2). Woods et al. continue, "Even in this most favourable scenario, producing a $> 10^9$ $M_\odot$ [more than a billion solar-mass] quasar from a typical~ 10–100 $M_\odot$ Pop III remnant [10–100 solar mass Population III remnant] would require an accretion time greater than the age of the Universe at $z \sim 7$ [redshift around 7], unless significantly lower radiative efficiencies may be invoked" (p. 2, bracketed notes added). In response to this challenge, astronomers (e.g., Johnson and Upton Sanderbeck, 2022) are considering the possibility of super-Eddington accretion (the "significantly lower radiative efficiencies" of the preceding quotation) as well as mechanisms to form massive SMBH seeds (of, say, 10^5 solar masses). The viability of these possibilities remains to be seen. At present, SMBHs seem inexplicable in terms of current processes.

A third possible discontinuity is the formation of the first galaxies. The James Webb Space Telescope (JWST) has discovered high-redshift galaxies (conventionally dated to 500–700 Myr after the Big Bang) with stellar masses more than ten billion times that of the Sun (Labbé et al., 2023). Another study has detected four galaxies (dated to 300–500 Myr after the Big Bang) with stellar masses roughly 100 million times that of the Sun (Robertson et al., 2023). These detections are in significant tension with the standard ΛCDM [Lambda cold dark matter] model (Forconi et al., 2023), because matter would not clump together fast enough to form these galaxies; even if it did, stars would not form quickly enough to build up the requisite stellar mass. In

15 Note that oxygen in water (Genesis 1:2) would be considered a metal.

other words, the galaxies are too many, too massive, and too early. And yet we have seen them within the first year of JWST's operation. These observations seem inexplicable in terms of the physics operating today.

Conclusion

Deuteronomy 29:29 declares, "The secret things belong to the Lord our God, but the things that are revealed belong to us and to our children forever, that we may do all the words of this law."[16] There are "secret things" which God has chosen not to reveal (see above under Ultimate Inexplicability). We cannot construct an accurate model of origins without recognizing—and resting in—the fact that the creation of the Universe is understood by faith (Hebrews 11:3).

For millennia, almost everything about the workings of the heavens fell into the category of "secret things." Today, however, God has chosen to reveal a wealth of cosmological data, which will expand many times in years to come (e.g., *Euclid*, Laureijs et al., 2011; the Nancy Grace Roman Space Telescope, Green et al., 2012; CMB-S4, Abazajian et al., 2019). The ultimate causes and methods of creation are still—and will surely forever remain—"secret things." This new data, however, falls into the category of "things that are revealed," and therefore these observational riches constitute a gracious invitation from our Lord to investigate them. He did not have to reveal them—He could have created a Universe without a cosmic microwave background, or with a featureless galaxy correlation function, etc.—but reveal them He did.[17]

The third paper in this series shall, Lord willing, examine some of the data which require integration into the creation model. This paper has outlined (and attempted to justify) three working assumptions for this task. The first is that the Universe (not the ultimate methods of creation, but the processes and patterns in the data) is intelligible. Patterns mean something; God did not reveal them for naught. Thus we must seek to understand them in a manner consistent with Scripture.

The second working assumption is that Creation Week left the Universe in a quasi-steady state, like a mature ecosystem. Thus, we are unsurprised to see evidence of multiple processes (including renewal processes) operating on vast timescales. These processes may well have been operative during Creation Week, though at vastly accelerated rates. In any case, present observations must, for intelligibility's sake, nevertheless be valid indicators of how these processes work, even if their rates were different during God's supraprovidential creation.

The final working assumption, ultimate inexplicability, returns to the "secret things" category. At the very least, the existence of the Universe and its design do not have naturalistic explanations. Nor does the acceleration of various processes during Creation Week. We should look for (but not presume upon) the existence of other causal discontinuities as well.

It is the author's hope that these working assumptions, combined with the testimony of Scripture, will facilitate the construction of a comprehensive creationary approach to cosmological data.

16 In context, "the things revealed" are the contents of the Torah ("all the words of this law"); however, the principle manifestly applies to any situation concerning which God has chosen to reveal some—but not all—information.

17 Note however that we must not treat nature as a 67th book of Scripture. Cosmological observations are general, non-verbal, and non-propositional revelation, with no guarantee of inerrancy to protect against observers' fallibility; they are thus subordinate to the special, verbal, propositional, inerrant revelation of Scripture.

References

CRSQ: Creation Research Society Quarterly

Abazajian, K., G. Addison, P. Adshead, Z. Ahmed, S.W. Allen, D. Alonso, M. Alvarez, et al. 2019. CMB-S4 science case, reference design, and project plan. *arXiv e-prints* arXiv:1907.04473.

Amon, A., D. Gruen, M.A. Troxel, N. MacCrann, S. Dodelson, A. Choi, C. Doux, et al. 2022. Dark Energy Survey year 3 results: Cosmology from cosmic shear and robustness to data calibration. *Physical Review D* 105(2):023514.

Austin, S.A. 2005. Do radioisotope clocks need repair? Testing the assumptions of isochron dating using K-Ar, Rb-Sr, Sm-Nd, and Pb-Pb isotopes. In Vardiman, L., A.A. Snelling, and E.F. Chaffin (editors), *Radioisotopes and the Age of the Earth*, Volume 2, pp. 325–392. Institute for Creation Research, El Cajon, CA.

Baumgardner, J.R. 2000. Distribution of radioactive isotopes in the Earth. In Vardiman, L., A.A. Snelling, and E.F. Chaffin (editors), *Radioisotopes and the Age of the Earth*, Volume 1, pp. 49–94. Institute for Creation Research, El Cajon, CA.

Bergman, J. 2007. Lack of fossil evidence for arthropod evolution is a major difficulty for neo- Darwinism. *CRSQ* 43(3):222–230.

Carroll, B.W., and D.A. Ostlie. 2007. *An Introduction to Modern Astrophysics,* 2nd edition. Pearson Addison Wesley, San Francisco, CA.

Chandra, V., and K.C. Schlaufman. 2021. Searching for low-mass Population III stars disguised as white dwarfs. *Astronomical Journal* 161(4):197.

Dawson, K.S., D.J. Schlegel, C.P. Ahn, S.F. Anderson, É. Aubourg, S. Bailey, R.H. Barkhouser, et al., 2013. The Baryon Oscillation Spectroscopic Survey of

SDSS-III. *Astronomical Journal* 145(1):10.

Dembski, W.A., 2002. *No Free Lunch: Why Specified Complexity Cannot be Purchased Without Intelligence*. Rowman and Littlefield, Lanham, MD.

Eisenstein, D.J., I. Zehavi, D.W. Hogg, R. Scoccimarro, M.R. Blanton, R.C. Nichol, R. Scranton, et al. 2005. Detection of the baryon acoustic peak in the large-scale correlation function of SDSS luminous red galaxies. *Astrophysical Journal* 633(2):560–574.

Faulkner, D.R., 1993. The role of stellar population types in the discussion of stellar evolution. *CRSQ* 30:8–11.

Faulkner, D.R., and D.B. DeYoung. 1991. Toward a creationist astronomy. *CRSQ* 28:87–92.

Forconi, M., A.M. Ruchika, O. Mena, and N. Menci. 2023. Do the early galaxies observed by JWST disagree with Planck's CMB polarization measurements? *arXiv e-prints* arXiv:2306.07781.

Frair, W. 2000. Baraminology—Classification of created organisms. *CRSQ* 37(2):82–91.

Green, J., P. Schechter, C. Baltay, R. Bean, D. Bennett, R. Brown, C. Conselice, et al. 2012. Wide- Field InfraRed Survey Telescope (WFIRST) final report. *ArXiv e-prints* arXiv:1208.4012.

Guliuzza, R.J. 2013. Continuous environmental tracking: An engineering framework to understand adaptation and diversification. In Whitmore, J.H. (editor). *Proceedings of the Eighth International Conference on Creationism*, Volume 8, pp. 158–184. Creation Science Fellowship, Pittsburgh, PA.

Hoyle, F., G. Burbidge, and J.V. Narlikar. 1993. A quasi–steady state cosmological model with creation of matter. *Astrophysical Journal* 410(2):437.

Humphreys, D.R. 2017. Biblical evidence for time dilation in the cosmos. *CRSQ* 53(4):297–305.

Ishiyama, T., K. Sudo, S. Yokoi, K. Hasegawa, N. Tominaga, and H. Susa. 2016. Where are the low-mass Population III stars? *Astrophysical Journal* 826(1):9.

Jaki, S.L. 1986. *Science and Creation: From Eternal Cycles to an Oscillating Universe*. Scottish Academic Press, Edinburgh, Scotland.

Jastrow, R. 1978. *God and the Astronomers*. W.W. Norton, New York, NY.

Johnson, J.L., and P.R. Upton Sanderbeck. 2022. A simple condition for sustained super-Eddington black hole growth. *Astrophysical Journal* 934(1):58.

Labbé, I., P. van Dokkum, E. Nelson, R. Bezanson, K.A. Suess, J. Leja, G. Brammer, K. Whitaker, E. Mathews, M. Stefanon, and B. Wang, 2023. A population of red candidate massive galaxies 600 Myr after the Big Bang. *Nature* 616(7956):266–269.

Laureijs, R., J. Amiaux, S. Arduini, J. Augu`eres, J. Brinchmann, R. Cole, M. Cropper, et al. 2011. Euclid definition study report. *ArXiv e-prints* arXiv:1110.3193

Lewis, G.F., and L.A. Barnes, 2016. *A Fortunate Universe: Life in a Finely Tuned Cosmos*. Cambridge University Press, Cambridge, UK.

Penrose, R. 2010. *Cycles of Time: An Extraordinary New View of the Universe,* 1st U.S. edition. A.A. Knopf, New York, NY.

Planck Collaboration, P.A.R. Ade, N. Aghanim, M. Arnaud, M. Ashdown, J. Aumont, C. Baccigalupi, et al. 2011. Planck early results. I. The Planck mission. *Astronomy and Astrophysics* 536:A1.

Planck Collaboration, N. Aghanim, Y. Akrami, F. Arroja, M. Ashdown, J. Aumont, C. Baccigalupi, et al. 2020. Planck 2018 results. I. Overview and the cosmological legacy of Planck. *Astronomy and Astrophysics* 641:A1.

Repp, A.S. 2022a. Fifty-seven years of creation astronomy—Part II: Issues and advances. *CRSQ* 59(2):81–91.

Repp, A.S. 2022b. Inflation, the multiverse, and the creator. *CRSQ* 58(3):162–174.

Repp, A.S. 2024. Groundwork for creation cosmology—Part I: Scripture. *CRSQ* 61(1):32–39.

Robertson, B.E., S. Tacchella, B.D. Johnson, K. Hainline, L. Whitler, D.J. Eisenstein, R. Endsley, et al. 2023. Identification and properties of intense star-forming galaxies at redshifts z > 10. *Nature Astronomy* 7:611–621.

Samec, R.G. 2005. On Eugenie Scott's address to the American Astronomical Society, Winter 2005. *CRSQ* 42(1):70–72.

Samec, R.G. 2016. The apparent age of the time-dilated universe II: Gyrochronology, magnetic orbital decay of close solar-type binaries and errata. *CRSQ* 53(1):42–57.

Samec, R.G., D. Caton, and D. Faulkner. 2022. New photometric observations and the first Wilson Program analysis of the totally eclipsing, solar-type binary, UU Camelopardalis. *Journal of the American Association of Variable Star Observers* 50(2):212.

Secco, L.F., S. Samuroff, E. Krause, B. Jain, J. Blazek, M. Raveri, A. Campos, et al. 2022. Dark Energy Survey year 3 results: Cosmology from cosmic shear and robustness to modeling uncertainty. *Physical Review D* 105(2):023515.

Snelling, A. 2014a. Radioisotope dating of meteorites: I. The Allende CV3 carbonaceous chondrite. *Answers Research Journal* 7:103–145.

Snelling, A. 2014b. Radioisotope dating of meteorites: II. The ordinary and enstatite chondrites. *Answers Research Journal* 7:239–296.

Snelling, A. 2014c. Radioisotope dating of meteorites: III. The eucrites (basaltic achondrites). *Answers Research Journal* 7:533–583.

Snelling, A. 2015a. Radioisotope dating of meteorites: IV. The primitive and other achondrites. *Answers Research Journal* 8:209–251.

Snelling, A., 2015b. Radioisotope dating of meteorites: V. Isochron ages of groups of meteorites. *Answers Research Journal* 8:449–478.

Tomkins, J.P., S. Arledge, and R.J. Guliuzza. 2022. Blind cave fish (*Astyanax mexicanus*) as a model system for continuous environmental tracking and adaptive engineering. *CRSQ* 58(4):289–296.

Tremonti, C.A., T.M. Heckman, G. Kauffmann, J. Brinchmann, S. Charlot, S.D.M. White, M. Seibert, et al. 2004. The

origin of the mass-metallicity relation: Insights from 53,000 star-forming galaxies in the Sloan Digital Sky Survey. *Astrophysical Journal* 613(2):898–913.

Vardiman, L., A.A. Snelling, and E.F. Chaffin (editors). 2005. *Radioisotopes and the Age of the Earth: Results of a Young-Earth Creationist Research Initiative*, Volume 2. Institute for Creation Research, El Cajon, CA.

Volonteri, M. 2012. The formation and evolution of massive black holes. *Science* 337(6094):544.

Woods, T.E., B. Agarwal, V. Bromm, A. Bunker, K.-J. Chen, S. Chon, A. Ferrara, et al. 2019. Titans of the early Universe: The Prato statement on the origin of the first supermassive black holes. *Publications of the Astronomical Society of Australia* 36:e027.

Zhivkov, A., and I. Tounchev. 2022. A computer-assisted proof for 100,000 years stability of the solar system. *arXiv e-prints* arXiv:2206.13467.

Radiocarbon and the Longevity of Prediluvian Patriarchs

Raul E. Lopez, Jr.

Key Words: aging, cancer, extinction, global warming, Ice Age, longevity, megafauna, Methuselah, prediluvian patriarchs, radiocarbon

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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 × 422×10^{-6} CO_2/air/ 28.97 gm mole air × 12 gm mole C-12.) 5.14×10^6 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 $dx/dt=R-x*\ln 2/t_{1/2}$ and deriving from that the formula $X_t=C(1-e^{-t/t1/2})$, (where $C=R*t_{1/2}/\ln 2$, 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 chemi-

cally 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, in-

deed, 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 ($37\times1012\times3\times109\times2=2.2\times10^{23}$). 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 super-centenarians.

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, $Y=400 \times X^{-0.25}$, 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.

References

Ali, Y.F., F.A. Cucinotta, L. Ning-Ang, and G. Zhou. 2020. Cancer risk of low-dose ionizing radiation. *Frontiers in Physics* 8:234. doi: 10.3389/fphy.2020.00234.

Appleby, A., M. Costello, and S. Rose. 1996. What are the sources of ionizing radiation? *State of New Jersey, Department of Environmental Protection, Radiation Protection Element*, (November 1996). https://www.nj.gov/dep/rpp/llrw/download/fact03.pdf.

Asimov, I. 1963. *Marvels of Science*. Collier Books, New York, NY.

Averitt, P. 1974. Coal resources of the United States, January 1, 1974. *Geological Survey Bulletin: Issue 1412*.

Bartlett, Z. 2014. The Hayflick limit. *Embryo Project Encyclopedia* (2014–11–14). ISSN: 1940–5030 http://embryo.asu.edu/handle/10776/8237.

Baumgardner, J.R. 2005. "^{14}C Evidence for a Recent Global Flood and a Young Earth." In *Radioisotopes and the Age of the Earth*, Volume 2:587–630. L. Vardiman, A.A. Snelling, and E.F. Chaffin (editors). Institute for Creation Research, El Cajon, CA, and Creation Research Society, Chino Valley, AZ.

Behjati, S., G. Gundem, D.C. Wedge, N.D. Roberts, P.S. Tarpey, S.L. Cooke, P. Van Loo, L.B. Alexandrov, M. Ramakrishna, H. Davies, S. Nik-Zainal, C. Hardy, C. Latimer, K.M. Raine, L. Stebbings, A. Menzies, D. Jones, R. Shepherd, A.P. Butler, J.W. Teague, M. Jorgensen, B. Khatri, N. Pillay, A. Shlien, P.A. Futreal, C. Badie, ICGC Prostate Group, U. McDermott, G.S. Bova, A.L. Richardson, A.M. Flanagan, M.R. Stratton, and P.J. Campbell. 2016. Mutational signatures of ionizing radiation in second malignancies. *Nature Communications* 7:12605. https://doi.org/10.1038/ncomms12605.

Berger, W.H., and P. Anderson. How much carbon in the ground? *Syllabus: Climate Change, USCD*. http://earthguide.ucsd.edu/virtualmuseum/climatechange1/04_2.shtml.

BP Press Office. 2019. BP statistical review of world energy 2019: An unsustainable path. *British Petroleum*, 68th edition, June 11. https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-statistical-review-of-world-energy-2019.html.

Brown, R.H. 1988. The upper limit of c-14 age? *Origins* 15(1):39–43. https://www.

grisda.org/origins-16008.

Brown, S. 2015. Why taller people are at greater risk of cancer. *World Cancer Research Fund International*, September 15. https://www.wcrf.org/why-taller-people-are-at-greater-risk-of-cancer/.

Callaway, E. 2015. How elephants avoid cancer. *Nature*. https://doi.org/10.1038/nature.2015.18534.

Campbell, C.D., R.F. Sage, F. Kocacinar, and D.A. Way. 2005. Estimation of the whole-plant CO_2 compensation point of tobacco (*Nicotiana tabacum* L.). *Global Change Biology* 11(11):1956–1967. https://doi.org/10.1111/j.1365–2486.2005.01045.x.

Chen, C., and R. Myneni. 2019. Humans are officially greening the Earth. Is that a good thing? *The Brink (Boston University)*. https://www.bu.edu/articles/2019/humans-are-officially-greening-the-earth-is-that-a-good-thing/.

CRUK. Brain, other CNS and intracranial tumours statistics. *Cancer Research UK*. https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/brain-other-cns-and-intracranial-tumours#heading-Zero.

Damon, P.E., and R.E. Sternberg. 1989. Global production and decay of radiocarbon. *Radiocarbon* 31(3): 697–703. https://doi.org/10.1017/S0033822200012297.

De Magalhães, J.P., and O. Toussaint. 2004. Telomeres and telomerase: A modern fountain of youth? *Rejuvenation Research* 7(2):126–133. http://doi.org/10.1089/1549168041553044.

DeSilva, J.M., J.F.A. Traniello, A.G. Claxton, L.D. Fannin. 2021. When and why did human brains decrease in size? A new change-point analysis and insights from brain evolution in ants. *Frontiers in Ecology and Evolution*, Volume 9. https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2021.74263910.3389/fevo.2021.742639.

Dherbert, J. 2019. "Missing" Ice Age Forests: Evidence for the Flood? *Creation Research Society Quarterly* 56(1):48–51.

Dillow, J.C. 1982. *The Waters Above: Earth's Pre-Flood Vapor Canopy*, revised edition. Moody Press, Chicago, IL.

Dippery, J.K., D.T. Tissue, R.B. Thomas, and B.R. Strain. 1995. Effects of low and elevated CO_2 on C3 and C4 annuals: I. Growth and biomass allocation. *Oecologia,* 101(1):13–20. doi: 10.1007/BF00328894. PMID: 28306970.

Douma, D. 2017. A comparison of patriarch ages in the Masoretic Text, Samaritan Pentateuch, and Septuagint. *A Place for Thoughts*. https://www.douglas-douma.com/2017/12/18/a-comparison-of-patriarch-ages-in-the-masoretic-text-samaritan-pentateuch-and-septuagint/.

Dunham, K. 2019. When and where was the Septuagint written? *Detroit Baptist Theological Seminary*. https://dbts.edu/2019/10/01/when-and-where-was-the-septuagint-written/.

Dunn, B., and M. Poudel. 2023. Greenhouse carbon dioxide supplementation. *Oklahoma Cooperative Extension Service, OSU*. https://extension.okstate.edu/fact-sheets/greenhouse-carbon-dioxide-supplementation.html.

Eames, C. 2020. Biblical longevity of the first humans. *Armstrong Institute of Biblical Archeology*. https://armstronginstitute.org/269-biblical-longevity-of-the-first-humans.

EIA. 2022. Coal explained. How much coal is left. *U.S. Energy Information Administration*.

Energy Institute. Statistical Review of World Energy. 2023. "Coal reserves (anthracite and bituminous)" [dataset]. *Energy Institute*, "Statistical Review of World Energy" [original data]. https://www.energyinst.org/statistical-review.

EPA. 2022. Radiation doses and sources. *Environmental Protection Agency*. https://www.epa.gov/radiation/radiation-sources-and-doses.

Fry, E., S.K. Kim, S. Chigurapti, K.M. Mika, A. Ratan, A. Dammermann, B.J. Mitchell, W. Miller, V.J. Lynch. 2020. Functional architecture of deleterious genetic variants in the genome of a Wrangel Island mammoth. *Genome Biology and Evolution* 12(3):48–58. https://doi.org/10.1093/gbe/evz279.

Garnier-Laplace, J., and S. Roussel-Debet. 2010, revised. Radionuclide sheet, carbon-14, and the environment. *IRSN (Institut de radioprotection et de sûreté nucléaire)*. https://www.irsn.fr/EN/Research/publications-documentation/radionuclides-sheets/environment/Documents/Carbone_UK.pdf.

Gewin, V. 2013. Massive animals may hold secrets of cancer suppression. *Nature*. https://doi.org/10.1038/nature.2013.12258.

Green, C., and K.A. Byrne. 2004. Biomass: Impact on carbon cycle and greenhouse gas emissions. *ResearchGate*. DOI:10.1016/B0–12–176480-X/00418–6. [*Encyclopedia of Energy*, 1.1 https://www.sciencedirect.com/topics/earth-and-planetary-sciences/global-carbon-cycle.]

Hauptmann, M., R.D. Daniels, E. Cardis, H.M. Cullings, G. Kendall, D. Laurier, M.S. Linet, M.P. Little, J.H. Lubin, D.L. Preston, D.B. Richardson, D.O. Stram, I. Thierry-Chef, M.K. Schubauer-Berigan, E.S. Gilbert, and A. Berrington de Gonzalez. 2020. Epidemiological studies of low-dose ionizing radiation and cancer: Summary bias assessment and meta-analysis. *JNCI (Journal of the National Cancer Institute) Monographs* 2020(56):188–200. https://doi.org/10.1093/jncimonographs/lgaa010.

Herbert, J. 2024. Late Pleistocene body size reduction: Evidence of a post-Flood decline in longevity? *Journal of Creation* 38(1):60–66.

Holliday, R. 1996. Neoplastic transformation: The contrasting stability of human and mouse cells. *Cancer Surveys* 28:103–115. PMID: 8977031.

Hörandel, J.R. (for the Pierre Auger Collaboration). 2012. The nature and origin of ultra high-energy cosmic rays. *Europhysics News* 43(3): 24–27. http://particle.astro.ru.nl/pub/europhysics-news.pdf; also in https://www.europhysics-news.org/articles/epn/pdf/2012/03/epn2012433p24.pdf.

Kanu, A.M., L.L. Comfort, T.P. Guilder-

son, P.J. Cameron-Smith, D.J. Bergmann, E.L. Atlas, S. Schauffler, and K.A. Boering. 2016. Measurements and modeling of contemporary radiocarbon in the stratosphere. *Geophysical Research Lett*ers 43:1399–1406, doi:10.1002/2015GL066921.

Lacis, A.A, G.A. Schmidt, D. Rind, and R.A. Ruedy. 2010. Atmospheric CO_2: Principal control knob governing Earth's temperature. *Scienc,* 330:356–359. DOI:10.1126/science.1190653.

López, R.E. 1998. The antediluvian patriarchs and the Sumerian King List. *Journal of Creation* 12(3):347–357.

Lüthi, D., M. Le Floch, B. Bereiter, T. Blunier, J.-M. Barnola, U. Siegenthaler, D. Raynaud, J. Jouzel, H. Fischer, K. Kawamura, and T.F. Stocker. 2008. High-resolution carbon dioxide concentration record 650,000–800,000 years before present. *Nature* 453:379–382. https://doi.org/10.1038/nature06949.

Mangeruda, J., S. Bondevikb, S. Gulliksenc, A.K. Hufthammerd, and T. Høisæter. 2006. Marine 14C reservoir ages for 19th-century whales and molluscs from the North Atlantic. *Quaternary Science Reviews* 25(23–24):3228–3245. https://folk.uib.no/ngljm/PDF_files/Mangerud_al_06.pdf.

Masarik, J., and J. Beer. 2009. An updated simulation of particle fluxes and cosmogenic nuclide production in the Earth's atmosphere. *Journal of Geophysical Research Atmosphere* 114(D11). doi: 10.1029/2008JD010557.

Matsumoto, K. 2007. Radiocarbon-based circulation age of the world oceans. *Journal of Geophysical Research* 112(C9):148–227. doi:10.1029/2007JC004095.

McClintock, J., and J. Strong. 1880. Melchizedek. *The Cyclopedia of Biblical, Theological, and Ecclesiastical Literature.* (Cited in biblicalcyclopedia.com). https://www.biblicalcyclopedia.com/M/melchizedek.html.

MNDH. 2024. Carbon dioxide (CO_2). *Minnesota Department of Health*. Last updated, October 8.
https://www.health.state.mn.us/communities/environment/air/toxins/co2.html.

Mortazavi, S.M.J., and H. Mozdarani. 2013. Non-linear phenomena in biological findings of the residents of high background radiation areas of Ramsar. *International Journal of Radiation Research* 11(1):3–9.

Oard, M.J. 2006. *Frozen in Time*. Master Books, Green Forest, AR.

OHSU. 2019. Cancer lab p53—Teacher background on p53 tumor suppressor protein. *Oregon Health and Science University.* https://www.ohsu.edu/sites/default/files/2019–02/3m.%20Cancer%20Lab%20%20p53%20-%20Teacher%20Background%20on%20p53%20Tumor%20Suppressor%20Protein.pdf

Repeta Group. 2025. Radiocarbon and the deep ocean cycling of dissolved organic matter. *Woods Hole Oceanographic Institution*. https://www2.whoi.edu/site/repetagroup/projects/age-of-deep-sea-dom/.

Rudd, S. 2017. Shem as Melchizedek. *The Interactive Bible.* https://www.bible.ca/manuscripts/Septuagint-LXX-Shem-was-Melchizedek-Masoretic-chronology-Messiah-Jesus-Christ-priesthood.htm.

Rush, D.E., and L. Vardiman. 1990. Pre-Flood vapor canopy radiative transfer profiles. In *Proceedings of the 2nd International Conference on Creationism*, pp. 231–245. R.E. Walsh (editor). Creation Science Foundation, Pittsburgh, PA.

Shah, D.J., R.K. Sachs, D.J. Wilson. 2012. Radiation-induced cancer: A modern view. *The British Journal of Radiology* 85(1020):1166–1173. doi: 10.1259/bjr/25026140. https://doi.org/10.1259/bjr/25026140.

Snelling, A.A. 2008. Radiocarbon ages for fossil ammonites and wood in Cretaceous strata near Redding, California. *Answers Research Journal* 1:123–144. https://answersresearchjournal.org/radiocarbon-ages-fossil-ammonites-wood/.

Stainforth, T., and B. Brzezinski. 2020. More than half of all CO_2 emissions since 1751 emitted in the last 30 years. *Institute for European Environmental Policy*.
https://ieep.eu/news/more-than-half-of-all-co2-emissions-since-1751-emitted-in-the-last-30-years.

Thomas, B. 2017. Two date range options for Noah's Flood. *Journal of Creation* 31(1): 120–127.

Tikhonov, A., L. Agenbroad, and S. Vartanyan. 2003. Comparative analysis of the mammoth populations on Wrangel Island and the Channel Islands. *Advances in Mammoth Research* 9:415–420.

Tiseo, I. 2022. Historic average carbon dioxide (CO_2) levels in the atmosphere worldwide from 1959 to 2021 (in parts per million). *Statista.* https://www.statista.com/statistics/1091926/atmospheric-concentration-of-co2-historic/.

Tollis, M., J. Robbins, A.E. Webb, L.F.K. Kuderna, A.F. Caulin, J.D. Garcia, M. Bèrubè, N. Pourmand, T. Marques-Bonet, M.J. O'Connell, P.J. Palsbøll, C.C. Maley. 2019. Return to the sea, get huge, beat cancer: An analysis of cetacean genomes including an assembly for the humpback whale (*Megaptera novaeangliae*). *Molecular Biology and Evolution* 36(8):1746–1763, https://doi.org/10.1093/molbev/msz099.

Ugai, T., N. Sasamoto, H-Y. Lee, M. Ando. M. Song, R.M. Tamimi, I. Kawachi, P.T. Campbell, E.L. Giovannucci, E. Weiderpass, T.R. Rebbeck, S. Ogino. 2022. Is early-onset cancer an emerging global epidemic? Current evidence and future implications. *Nature Reviews Clinical Oncology* 19(10):656–673. https://doi.org/10.1038/s41571–022–00672–8.

Vardiman, L., and K. Bousselot. 1998. Sensitivity studies on vapor canopy temperature profiles. In *Proceedings of the Fourth International Conference on Creationism*, pp. 607–618. R.E. Walsh (editor). Creation Science Foundation, Pittsburgh, PA.

Wolin, K.Y., K. Carson, and G.A. Colditz. 2010. Obesity and cancer. *The Oncologist* 15(6):556–565. https://doi.org/10.1634/theoncologist.2009–0285.

Worraker, W. 2020. Heat problems associ-

ated with Genesis Flood models—Part 3: Vapour canopy models. *Answers Research Journal* 13:69–94. https://answersresearchjournal.org/heat-problems-Flood-models-3/.

Yapp, C.J., and H. Poths. 1992. Ancient atmospheric CO_2 pressures inferred from natural goethites. *Nature* 355(6358):342–344.

Yue, X.-L., and Q.-X. Gao. 2018. Contributions of natural systems and human activity to greenhouse gas emissions. *Advances in Climate Change Research* 9(4):243–252. https://doi.org/10.1016/j.accre.2018.12.003.

Zeebe, R.E., and D.A. Wolf-Gladrow. 2001. Carbon dioxide, dissolved (ocean). In *CO_2 in Seawater: Equilibrium, Kinetics, Isotopes*. Elsevier, Amsterdam, Netherlands. https://www.soest.hawaii.edu/oceanography/faculty/zeebe_files/Publications/ZeebeWolfEnclp07.pdf.

Zhu, Z., S. Piao, R. Myneni, et al. 2016. Greening of the Earth and its drivers. *Nature Climate Change* 6:791.

Notes from the Panorama of Science

The Deep

On Day One of Creation Week, we read, "In the beginning God created the *heaven* and the earth. And the earth was without form and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters" **(**Genesis 1:1–2 KJV). The 'deep' (*t^ehom*) means 'large body of water.' These verses tell us that, at first, there was only darkness and nothingness, but God had created the space and the matter, perhaps, from which all the physical universe would be constructed. The waters of the deep were a major part of this creation, and perhaps were the form of the original matter (Humphreys, 2020).

Since the sun, moon, and stars were not created until Day Four, we see that the water was created in the coldness of space. At a recent American Astronomical Society meeting (in June 2023), the astrochemist, Dr. Ted (Edwin) Bergin, Chairman of the Department of Astronomy of the University of Michigan, was giving a plenary, evolutionary talk on the birth of the planets (Bergin, 2023). *He stated that the waters in our present oceans formed (due to the deuterium content) at a temperature below 30K!* When asked (by me), he stated this information was determined from the kinetic chemistry of the water. This means that chemistry has confirmed that the water on earth was created in the *absence of the sun* (as the Bible tells us in Genesis 2:16)! The sun, moon, and stars were not created until Day Four, a day after the plants were created. This means that electromagnetic energy was directed to the earth by a means other than from the sun. This is also known since the earth was rotating in order to make the days needed for creation. The light from a source other than the sun was directed to the rotating earth, making a day-lit side and a darkened, night side. Genesis 1:4b–5 states, "... and God divided the light from the darkness. And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day." See Figure 1. The source of the light was the Lord. In Psalms 102:1, 2 (KJV), it is stated, "Bless the Lord, O my soul. O Lord my God…thou art clothed with honor and majesty. Who coverest thyself with light as with a garment." Here we see that light was manifested by and in God himself. In 1 John 1:5a, we read, "God is light; in him there is no darkness at all."

Also, we know that these days were ordinary Planet Earth periods of darkness and light from Exodus 20:9–11 (KJV). "Six days shalt thou labour, and do all thy work: But the seventh day is the sabbath of the Lord thy God: in it thou shalt not do any work, thou, nor thy son, nor thy daughter, thy manservant, nor thy maidservant, nor thy cattle, nor thy stranger that is within thy gates: For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested the seventh day: wherefore the Lord blessed the sabbath day, and hallowed it." Thus, the days of Creation Week were equivalent to ordinary working days—the literal, solar (i.e., single earth rotation) variety, rather than day-ages or prophetical epochs such as 'the day of the Lord.'

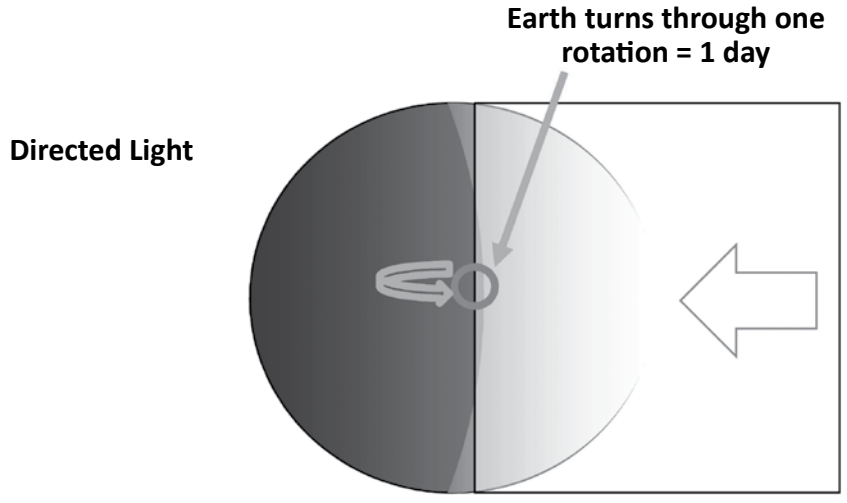

Figure 1. Light directed toward the rotating body of the Earth, 1 axial rotation = 1 day.[1]

Ronald G. Samec, Ph.D., retired
Former Professor,
Bob Jones University
Professional Astronomer

References

Bergin, E. 2023. The Birth of Planets and the Story of Carbon. Laboratory Astrophysics Division Meeting (LAD) Plenary Lecture, Ann Arbor, MI.

Humphreys, D. R. 2020. Creation Cosmology. *The 8th Annual Society of Creation Conference*. www.SocietyofCreation.org.

Why Do So Many Biologists Believe in Evolution?

Interest is growing in understanding the technologies used in biology, and there is a keen interest in applying the insights gained to manufacture new engineering devices. There are many well-known examples. Wall-climbing robots were inspired by the tiny hair-like structures on geckos' toe pads that allow them to climb smooth vertical surfaces (Santos et al., 2007). Speedo Fastskin swimwear was designed to reduce drag after analyzing the toothlike scales called dermal denticles found on shark skin (Wang, 2022). Self-cleaning coatings used in glass, fabrics, and building materials were inspired by the micro-structured surface on lotus leaves that repel water and dirt (Forbes, 2008). Color E-ink technology was inspired from the nanostructures on butterfly wings that create vivid colors through light interference (*Inavate News*, 2015). The new fields are referred to by terms such as biomimetics, biomimicry, biologically inspired engineering, bionics, bioengineering, nature-inspired design, and bioinspired design. Engineers are also applying their training in a field called biomechanics to understand the strategies used to optimize movement and interactions between parts.

Many engineers, medical doctors, and biologists are pooling their expertise, attracting chemists, physicists, and mathematicians in the process. Retro-engineering principles are being applied at levels ranging from molecular biology, anatomy & physiology, and to ecological systems. Some recent books illustrate the insights which can be gained through these interdisciplinary collaborations (Burgess, 2008, 2013; Galloway, 2021; Laufmann and Glicksman, 2022). Many technical papers and specialist journals are providing additional descriptions of the biological technologies being discovered, such as the *Journal of Biological Engineering*, *Bio-systems Engineering*, *Computational and Structural Biotechnology Journal*, *Systems Biology and Applications*, and *Journal of Cellular and Molecular Bioengineering*.

No Value in Claiming That Evolution Just Did It

The increasing interest in biology by engineers and scientists originally trained in other disciplines is posing a challenge to the evolutionary community. Why is this? Although these enthusiastic newcomers had usually never objected to the claims by evolutionists, they are discovering they have made an incorrect assumption. Their expectation had been that the established experts of each scientific field carry the responsibility to formulate and critically challenge theories, retaining those supported by strong evidence and objectively discarding the rest. The presumption was that biologists have been held to the same standards as chemists, physicists, engineers, doctors, and other specialists are. For example, a medical doctor does not agonize over whether the 1st and 2nd laws of thermodynamics have been demonstrated; that is the responsibility of experts in other disciplines.

Having been raised in cultures and educational systems which claim that evolution is an established fact, some engineers who have been biology enthusiasts simply ignore evolutionary claims on the basis that it provides no guidance to their methodologies. They have been trained to identify goals with identifiable tradeoffs and constraints which they then systematically attempt to resolve as optimally as possible. Well-known principles and methodologies include: Requirements Analysis, Systems Engineering; Design Optimization, Failure Modes and Effects Analysis (FMEA), Quality Function Deployment (QFD), Value Engineering, Control Systems Design, and Decision Matrices.

Doubts About Evolution Are Rising

However, detailed analysis of organisms is revealing biochemical technologies of unsuspected sophistication, responsible for life-defining features such as autonomous replication, repair, homeostasis, adaptation, and recycling. Cells, the fundamental basic unit of life, are now recognized to fulfill three key roles: as building blocks; information carriers; and to construct molecular machines. They produce proteins, lipids, sugars, and other biochemicals needed to construct more cells and maintain others and contain genetic instructions required to assemble the architecture of the entire human body. Self-assembly of bodies occurs through a set of hierarchical and often parallel processes beginning from a single cell (zygote). Engineers quickly recognized that they would be foolish to attempt to design anything remotely as complex with current know-how.

During lengthy discussions with engineers (some of whom also seem to have become addicted to molecular biology), the unique perspectives of technologists are being expressed. What principles would be necessary to build a system able to reliably *self-assemble* using about 36 trillion cells comprised of over 400 cell-types (Hatton et al., 2023) generation after generation? Massive parallelization, modularization, standardization, and reuse of the same cell types would be necessary, along with extensive quality-control measures based on feedback from sensors. All these have been discovered to be part of the development processes of the human body. Figure 1 provides some examples of parallelization,

modularization, and standardization in biology and engineering.

Having worked 40 years for the world's largest chemical manufacturing firm, where hundreds of plants are integrated using a concept called *Verbund*, I can appreciate their bewilderment. Our carefully designed Verbund sites require non-stop monitoring by hundreds of operators along with complex computer-control systems. Building them requires decades of planning involving hundreds of firms. And these are merely toys compared to even a single of the trillions of cells.

Having become infested with the molecular biology disease decades ago, I have been asked by perplexed engineers:

How exactly does evolution work and what evidence is there to back it up?

They clearly understand the claim that natural chemical processes allegedly created a Last Universal Common Ancestor (LUCA) from which all living organisms then derived through mutations and natural selection, with no divine guidance. To engineers, chemists, and physicists, that is not exactly intuitively plausible, but then they are not biologists. What do biologists know about evolutionary mechanisms which apparently no other scientists do?

What Are Evolutionary Biologists Actually Claiming?

There are many reasons why the alleged fact of evolution is accepted. Probably the key one will be addressed here. The first step is to recognize that the word *evolution* has been reified to represent a creative force able to produce the kinds of miracles one would attribute to God. Scientists have a vague intuition involving incomprehensibly long time periods and a creative force able to discover and fine-tune any feature which would be useful. The fundamental weapon used is the relentless suggestive claim found in

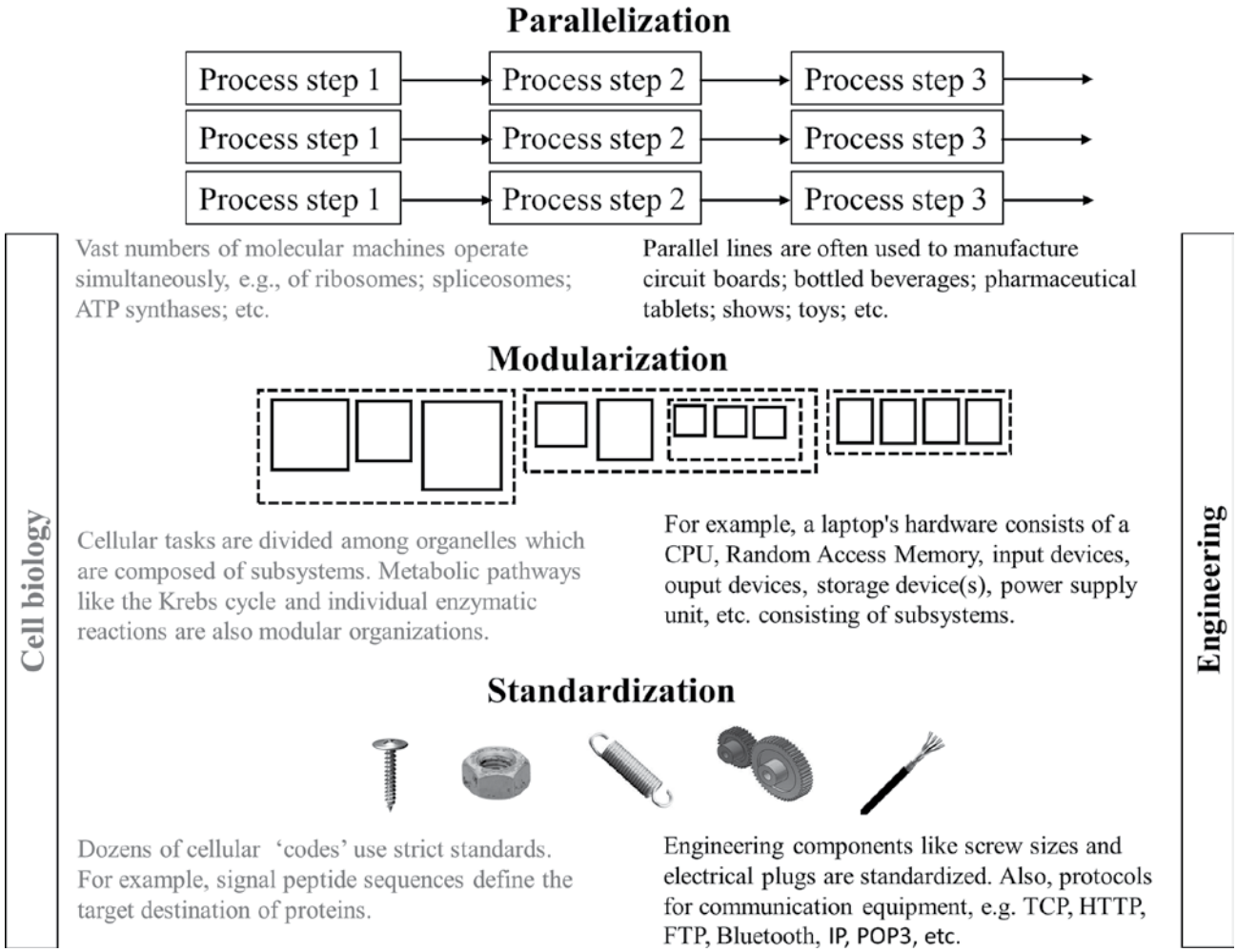

Figure 1. Parallelization, modularization, and standardization are common techniques used to design large, complex systems in biology and engineering.

virtually every biology publication that *evolution* naturally explains the features being discussed and that the observations were entirely expected thanks to *evolution*. Here are some examples taken from papers read the last day or two.

> "Given this widespread significance, it is not surprising that sophisticated mechanisms have *evolved* to tightly regulate 26S proteasome assembly, abundance and activity in response to demand, organismal development and stress." (Marshall and Vierstra, 2019; emphasis added)

In other words, an unimaginably complex system like the proteasome which identifies the correct proteins to be recycled at the right time, location, and cell type without damaging the other proteins required a very sophisticated regulatory mechanism which unsurprisingly *evolution came up with*.

Here is a typical example of post-facto reasoning:

> "This discrepancy points to the stark *evolutionary divergence* in the molecular mechanisms controlling the biosynthesis of tRNA in eukaryotes." (Nayef, Mani and Ramanathan, 2021; emphasis added)

In other words, the tRNA coding genes and biosynthesis processes used by tRNAs are completely different between prokaryotes and eukaryotes, but also between for example mammals and yeast, which are eukaryotes. Instead of admitting that this contradicts the notion of a LUCA, the authors imply that evolution is also the explanation for why organisms are so different. The rules are clear: if features are shared, it is due to evolution. If features are not shared, it is due to evolution.

Here is an example of evolution supposedly employing foresight with a purpose and goal in mind:

> "To prevent the use of mischarged tRNAs in protein synthesis, some synthetases have *evolved* editing activities that specifically target and hydrolyze misactivaed [sic] amino acids and/or misacylated tRNAs." (Rubio, Angel and Ibba, 2020; emphasis added)

Notice how meaningless these kinds of references to evolution are. Here one could eliminate the word 'evolved' without changing the meaning at all. Typical of such claims is the lack of any attempt to justify the claim. For example, precisely editing all but only the correct nucleotide atoms on tRNAs requires extraordinarily complex enzymes. How did the genetic system work before with non-functional tRNAs until all the new enzymes became available?

The same authors also claimed that,

> "The *evolutionary pressure* to maintain fidelity has driven aaRSs [Aminoacyl-tRNA synthetases] to develop an elevated specificity for their substrates." (Emphasis added)

The notion of 'evolutionary pressure' reflects a mental imagery of some naturalist causal force able to invent and optimize new processes despite no knowledge of the solution to be found.

Even AI systems such as ChatGTP and Gemini make evolutionary claims, for example:

> "Cells have *evolved* multiple pathways to manage the potential issues arising from racemized amino acids and nucleotides."

As usual, simply removing the word *evolved* would not change anything in this statement.

Evolutionary biologists have been engaged in a relentless campaign to ensure scientists are assured of the absolute truth of evolution, which the mass media dutifully regurgitates.

What Is Meant by 'Evolution'?

The logic is as simple as it is absurd: Extraordinarily sophistically biological features exist, but evolution is indisputable and the only explanation for life.

∴ Evolution must have miraculous creative abilities.

This absurd conclusion, founded on faulty premises, underlies the vague intuition used whenever the word evolution is used in most discourse. *Evolution can do anything* and far better than humans could design.

Processes Claimed to Produce Major Evolutionary Innovation

Rarely are the evolutionary processes mentioned through which complex new features could have arisen. Instead, publications are flooded with phrases like, *fine-tuned by evolution*, *through evolutionary processes*, *in the course of evolution*, or *through evolutionary pressure*. Most readers, especially those early in their careers who have not given evolution theory much thought, assume incorrectly that some tangible concept lies behind the superfluous phrases.

A special evolutionary language has developed to make claims which sound scientific but are merely post facto narratives lacking any evidence. If some feature is shared across a wide range of organisms, it can be called either *highly conserved* or due to *convergent evolution*, whatever seems more plausible to visualize. If the feature is more different than expected based on an assumed recent common ancestor (or the feature is absent), the editors can recommend calling it a *remarkable example* of *rapid evolution*. Often evolutionary lingo includes terms where an underlying mechanism is not even implied, like convergent evolution and homology (which could mean common ancestry, similar function, etc.).

Evolutionary mechanisms such as those mentioned in Table I allegedly created sophisticated new features and classes of organisms. One cannot over-emphasize that none of these have

been shown to be capable of producing (even in concept) new features beyond those distributed among organisms at the family or lower taxonomic level. Remarkably, *all of these mechanisms have been or could be invoked by creationists* to explain pre-planned adaptability, variability and robustness to environmental changes.

There are various Old-Earth Creationist, Young-Earth Creationist (YEC), and Progressive Creationist models which can or could include all the processes shown in Table I. Since all these creationists deny the existence of a LUCA and that natural processes based on random mutations with no divine guidance nor purpose produced extant life, *none of these mechanisms can be claimed to support evolution*. YECs believe in rapid speciation from a limited variety of organisms after Noah's Flood, and not only would all the entries in the table be acceptable in reconstruction models (Carter, 2021a, 2021b, 2021c), most make more sense if short time periods are involved.

For example, phylogenetic inertia over hundreds of millions of years is far less plausible than over thousands of years. Consider mutations as another example. YEC Dr. Sanford has pointed out that human genomes are unlikely to be more than a few thousand years old or entropy would have destroyed them (Sanford, 2014). Many YEC geneticists have published models on how novelty and speciation could have been designed to occur rapidly, using concepts such as loss of heterozygosity and transposable elements, which evolutionists don't seem to have considered yet. None of these additional mechanisms imply evolution (Borger, 2018; Crompton et al., 2023).

In summary, the "proof" of evolution, meaning producing a LUCA from random chemicals followed by diver-

Table I. Proposed mechanism able to modify traits and potentially create new species.

Mechanism	Explanation
Adaptive Radiation	Rapid change of diversity when a subpopulation is transferred to new environments.
Allopatric Speciation	Speciation that occurs when subpopulations become physically isolated by a physical barrier.
Balancing Selection	Genetic diversity is maintained by retaining alternative alleles as a form of insurance.
Bottleneck Effect	A sharp decrease in population size facilitating genetic drift.
Co-evolution	Changes between pairs or groups of species in response to each other.
Developmental Plasticity	The ability to change a developmental path in response to environmental conditions.
Exaptation	A trait or gene that gets co-opted for a new function.
Founder Effect	Reduced genetic diversity when a few individuals migrate to a new location.
Gene Flow	The transfer of genetic material between separate populations, possibly altering allele frequencies.
Genetic Drift	Random changes in allele frequencies in a population.
Group Selection	Natural selection acts on groups, favoring traits that benefit the group.
Heterochrony	Changes in the timing or rate of developmental events, leading to changes in size and shape.
Horizontal Gene Transfer	Exchange of genetic material between organisms instead of through inheritance, observed in prokaryotes.
Kin Selection	Reproductive success of an organism's relatives is maximized through altruistic behavior.
Mutation	Changes in the DNA sequence in the germline.
Niche Construction	Organisms modify their niches, affecting their adaptation.
Parapatric Speciation	Speciation occurring when populations are partially isolated but maintain some gene flow.
Phylogenetic Inertia	Some ancestral traits are retained due to functional constraints.
Polyploidy	When organisms have extra sets of chromosomes leading to speciation, especially in plants.
Punctuated Equilibrium	Species remain stable for long periods, with significant changes occurring in short, rapid bursts.
Stabilizing Selection	When natural selection favors the average individuals and reduces variation.
Sympatric Speciation	Speciation within the same geographical area due to habitat differentiation, or sexual preferences.

sification into all current organisms, is based on mind-numbing repetition that evolution was the underlying cause, repeated in virtually all biology publications, claims resting on nothing more than speculation. It is difficult not to wonder why this non-informative repetition should be so important.

Fortunately, thoughtful people not willing to mindlessly accept implausible claims are raising their voices. In a candid 2024 interview, well-known news commentator Tucker Carlson weighed in on the topic of evolution. His interviewer claimed that evolution could be measured in certain animals, but Carlson objected.

> "You can measure adaptation but there's no evidence [for evolution]. In fact, I think we have kind of given up on the idea of evolution; the theory of evolution as articulated by Darwin is kind of not true." (Carlson, 2024)

Dr. Royal Truman
Mannheim, Germany

References

Borger, P. 2018. *Darwin Revisited: Or How to Understand Biology in the 21st Century*. Scholar's Press, Chico, CA. ISBN-13: 978–6202315111.

Burgess, S. 2008. *In God's Image: The Divine Origins of Humans*. Day One Publications, Leominster, UK. ISBN-13: 978–1846251009.

Burgess, S. 2013. *The Design and Origin of Man*. Day One Publications, Leominster, UK. ISBN-13: 978–1846253928.

Carlson, T. 2024. Darwin's theory of evolution was wrong. https://www.youtube.com/watch?v=eARLm7dcgSI&ab_channel=LibertyVault.

Carter, R. 2021a. Species were designed to change, part 1. But how much change is allowed?, *Creation.com,* https://creation.com/species-designed-to-change-part-1. Published 1 July 2021.

Carter, R. 2021b. Species were designed to change, part 2. Speciation and the limits of change. *Creation.com.* https://creation.com/species-designed-to-change-part-2. Published 22 July 2021.

Carter, R. 2021c. Species were designed to change, part 3. The tangled web of (intrabaraminic) life. *Creation.com.* https://creation.com/species-designed-to-change-part-3. Published 12 August 2021.

Crompton, N., T. Sprague, R. Truman, and R. Junker. 2023. Mendelian speciation, part 1—What is the abundant source of significant biodiversity? *Journal of Creation* 37(3):110–120. (First of a 5-part series).

Galloway, D.J. 2021. *Design Dissected: Is the Design Real?* John Ritchie, Ltd. ISBN-13: 978–1914273001.

Forbes, P. 2008. Self-cleaning materials: Lotus leaf-inspired Nanotechnology, *Scientific American* 299(2):88–95.

Hatton, I.A., E.D. Galbraith, N.S.C. Merleau, T.P. Miettinen, B. McDonald Smith, and J.A. Shander. 2023. *PNAS* 120(39):e2303077120, September 18.

Inavate News. 2015. Tablet with butterfly wings '" video included. https://www.inavateonthenet.net/news/article/tablet-with-butterfly-wings-video-included.

Laufmann, S., and H. Glicksman. 2022. *Your Designed Body*. Discovery Institute, Seattle, WA. ISBN-13: 978–1637120200.

Jarrous, N., D. Mani and A. Ramanathan. 2022. Coordination of transcription and processing of tRNA. *The FEBS Journal* 289(30):3630–3641.

Marshall, R.S., and R.D. Vierstra. 2019. Dynamic regulation of the 26S Proteasome: From synthesis to degradation. *Frontiers in Molecular Biosciences* 6:40, June 7.

Rubio Gomez, M.A., and M. Ibba. 2020. Aminoacyl-tRNA synthetases. *RNA* 26(8):910–936.

Sanford, J.C. 2014. *Genetic Entropy*. FMS Publications, Canandaigua, NY. ISBN-13: 978–0981631608.

Santos, D., S. Kim, M. Spenko, A. Parness, and M. Cutkosky. 2007. Directional adhesive structures for controlled climbing on smooth vertical surfaces. *Proceedings 2007 IEEE International Conference on Robotics and Automation*, Rome, Italy, pp. 1262–1267.

Wang, M. 2022. Shark skin-inspired materials have a long way to go before they work like the real thing, *Smithsonian Magazine*, October 20. https://www.smithsonianmag.com/innovation/shark-skin-inspired-materials-have-a-long-way-to-go-before-they-work-like-the-real-thing-180980973/.

Did a Cretaceous Antarctic Ammonite Live (at Least) Two Centuries?

A conventional paleoecologist has concluded that the large extinct Late Cretaceous ammonite *Diplomoceras maximum* had a lifespan of 200 years (Ivany, 2020; Yirka, 2020). Virtually all creationists consider Cretaceous strata to be Flood deposits. Could this be additional confirmation that pre-Flood animals were experiencing extreme longevity, just as pre-Flood humans were (Genesis 5)?

D. maximum was a large heteromorph ammonite, that is, one whose shell was not a regular spiral. In appearance, it was somewhat similar to a squid, with a "hamitocone" shell bearing a strong resemblance to a paperclip (Figure 1). The *D. maximum* specimen studied had a shell length of 1.5 meters, with an uncoiled length of about 3 meters (Artruc and Ivany, 2016).

Long-Lived Antarctic Molluscs

Linda C. Ivany, a Syracuse University paleoecologist, has contributed significant works in the field of sclerochronology, the science of determining an organism's age by counting growth rings or bands in hard body parts (Moss, Ivany, and Jones; 2021). She has previously performed research that demonstrates 'extreme' longevity in extinct Cretaceous and Eocene bivalves from Seymour Island, located at the tip of the Antarctic Peninsula (Buick and Ivany, 2004; Moss et al., 2017). These findings were discussed briefly in Hebert (2023). Some extant creatures living in cold water, such *as Somniosus microcephalus* (the Greenland shark) and the clam *Arctica islandica*, have lifespans of hundreds of years (Abele et al., 2008; Nielsen et al., 2016). These long lifespans are generally attributed to greatly slowed metabolisms as a result of living in cold water and/or caloric restriction (Moss et al., 2017; O'Connor, 2017). However, based on oxygen isotope values obtained from the bivalve shells, uniformitarian geologists believe these bivalves lived in warmer water (Buick and Ivany, 2004; Moss et al., 2017) that was between 8° and 17° Celsius (46° and 63° Fahrenheit).

Creationists have suggested that the pre-Flood world was considerably warmer than today (Whitcomb and Morris, 1991; Humphreys, 2009), likely including Antarctica. Oard (2014) acknowledges this possibility but notes the apparent difficulties for a warm pre-Flood Antarctica:

> It is easier to envision the Arctic being warm but not Antarctica because there is an ocean at the North Pole rather than a high-relief land mass. A warm Arctic Ocean would warm the surrounding high latitudes, but Antarctica should have been relatively cool because of its high latitude. High-latitude continents cool off considerably at night and in winter, especially with four to six months of total darkness. In addition, without the weight of today's ice sheets applying isostatic downward pressure, Antarctica would presumably have been at higher altitude before glaciation, thereby enhancing the effects of cooling.

However, Clarey (2020) has suggested that pre-Flood Antarctica was at a lower paleolatitude, which would have resulted in a warmer climate. Indeed, Scripture seems to demand that all the pre-Flood, land-surface Earth (including pre-Flood Antarctica) was sufficiently warm for vegetation, since God told Adam and Eve (Genesis 1:29), "Behold, I have given you every herb bearing seed, which is upon the face of *all* the earth…(emphasis mine)."

If the pre-Flood Antarctic climate was indeed warm, then the extreme longevity of these bivalves was truly exceptional, as they could not have been the result of cold temperatures, and a more ideal pre-Flood biosphere would seem to make caloric restriction unlikely.

Fossil Description

Ivany's conclusion of extreme longevity in *D. maximum* was based upon a study of a fossil specimen found in the Late Cretaceous part of the López de Bertodano Formation at the southwestern end of Seymour Island, Antarctica. This research was described in the honors thesis of student Emily G. Artruc (2016), whose research was done under Dr. Ivany's supervision.

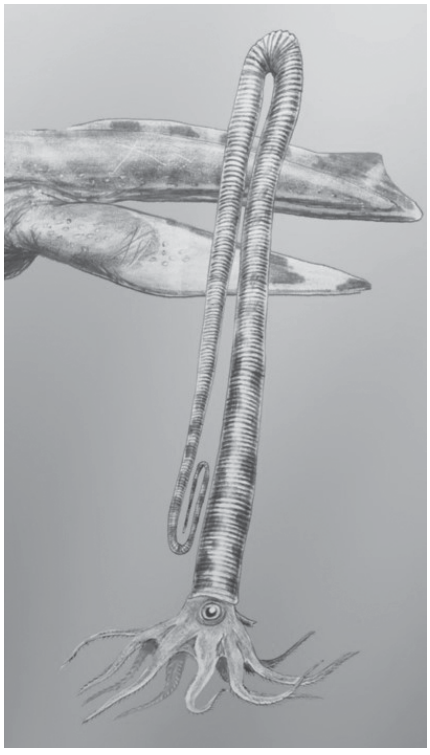

Figure 1. Artist reconstruction of the paper-clip-shaped heteromorph ammonite *Diplomoceras maximum*. Image Credit: Dmitry Bogdanov. CC BY 3.0. https://creativecommons.org/licenses/by/3.0/.

Uniformitarian paleontologists interpret the López de Bertodano Formation as a low-energy, marine open-shelf environment. Artruc (2016) and Ivany (2020) made a number of observations about the $\delta^{18}O$ and $\delta^{13}C$ values that were measured along a half-meter-long section of the *D. maximum shell* (Figure 2). This shell section contained the hook and two adjoining shafts of the 'paperclip.' They found that the $\delta^{18}O$ and $\delta^{13}C$ values covaried with one another, with consistently depleted values measured between sculptural surface ribs. They also determined that the $\delta^{18}O$ amplitudes were "unremarkable," with an amplitude of no more than about 2 to 3‰ (bottom chart in Figure 2). However, variation in the $\delta^{13}C$ values was much larger, with values of about -34‰ between adjacent ribs, and ~0‰ on the ribs, particularly on the "hook" section of the shell. The significance of the large range in $\delta^{13}C$ values is explained below. Both the $\delta^{18}O$ and $\delta^{13}C$ values are characterized by a long-wavelength, sinusoidal variation upon which are imposed much shorter-wavelength cycles, as shown in Figure 2.

Conclusions about this ammonite's lifespan and rate of growth depend greatly upon their assumed annual cyclic variation. If the long-wavelength variations are annual, then this implies a younger age at death than if the short-wavelength patterns are annual. About one-and-a-half long-wavelength cycles are shown in the 0.5-meter-long uncoiled segment shown in Figure 2. If one assumes, as Ivany and Artruc originally did, that the long-wavelength variations are annual, then the total number of years represented in the 3-meter-long uncoiled shell is about 1.5×6 = 9 years (Artruc and Ivany, 2016).

Artruc and Ivany noted a number of possible explanations for the extreme $\delta^{13}C$ values. They ruled out post-depositional diagenetic alteration and contamination by the matrix or cement surrounding the shell. They concluded that the very low $\delta^{13}C$ values were likely due to hydrocarbon seeps in the López de Bertodano Formation that are thought to have supported chemosymbiotic faunal communities.

The *D. maximum* $\delta^{18}O$ and $\delta^{13}C$ values showed greater similarities with those of presumed benthic organisms than with pelagic ones. Hence, they concluded (Artruc, 2016, p. 16) that "*Diplomoceras* most likely occupied a demersal habitat: pelagic, but near the sea floor."

A Change of Mind

Although Ivany originally concluded that *D. maximum* had a lifespan of only 9 years, she reversed herself in an invited presentation to the 2020 Geological Society of America: "[r]ecently published data from co-occurring bivalves exhibit very low $\delta^{13}C$ values in

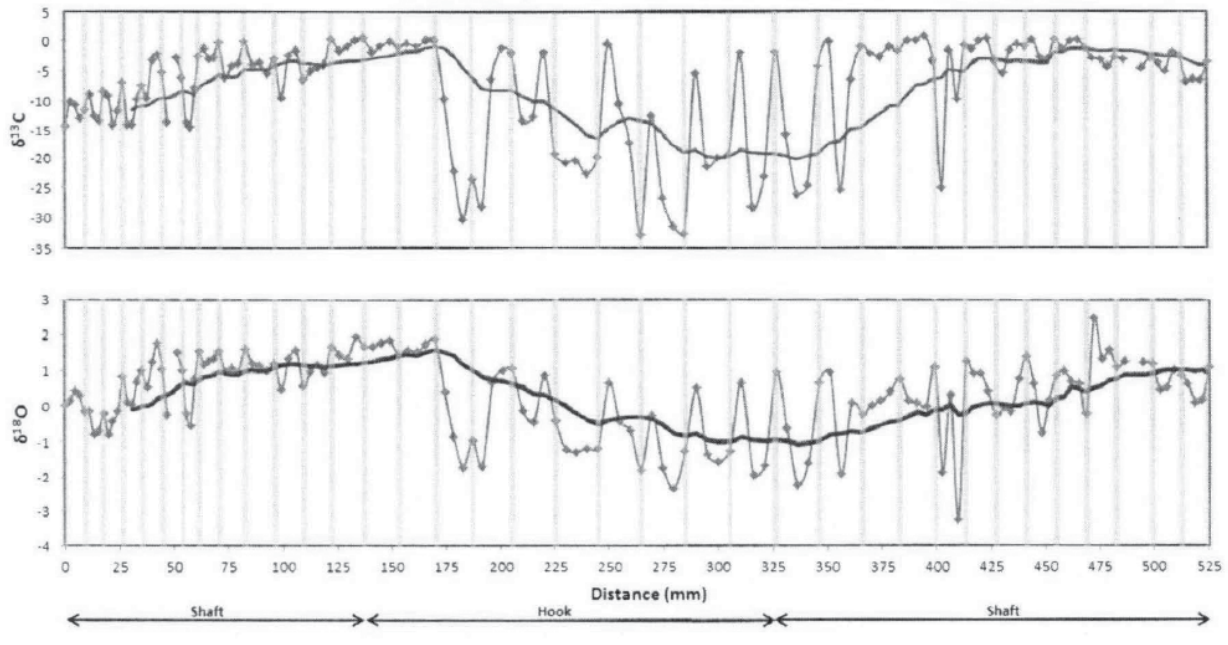

Figure 2. Figure 1 from open-access paper Artruc (2016). Graphs showing the $\delta^{13}C$ variations (top) and $\delta^{18}O$ variations (bottom) in the 52.5-centimeter-long *D. maximum* shell section. The "shaft" and "hook" sections of the shell are labeled at bottom. Trend lines were obtained with 15-point moving averages.

association with clear annual growth bands, thereby requiring that intra-rib depletions are annual." Without access to the transcript of Ivany's talk, it is not immediately clear to which data she is referring, as the abstract to her presentation does not elaborate on the details. If one assumes that the low-wavelength variations are annual, then the half-meter-long shell section data in Figure 2 show ~36 presumed annual cycles over a half-meter distance. Thus, the total uncoiled 3-meter-long shell should represent ~6 × 36 = 216 years.

This conclusion does not seem to have been formally published, although in some ways that may not be surprising. Ivany's change of mind on this issue was not based on any change in the data presented in Artruc's thesis, but only on other fossil data that caused her to revise her interpretation of that data. Hence, there was nothing much to add to the original analysis except the revised conclusion about lifespan. Ivany (2020) concluded, "Ammonite paleobiologists must therefore find ways to accept the reality of extreme longevity in this enigmatic animal."

If this interpretation of the shell isotope data is correct, this is more evidence that pre-Flood animals were exhibiting extreme longevity. Of course, it should be noted that the estimated age of 200 years is only the age at which this organism died in the Flood; its true lifespan potential could have been even longer.

Creationist Longevity Predictions and Research

Other creation researchers (Patten, 1982; Beasley, 1990; Cuozzo, 1998, 1999) predicted that delayed maturation and/or giantism would be associated with long-lived creatures, and recent creation research has revealed indirect and direct evidence in favor of this hypothesis in fossil sharks (Hebert, 2024a; Hebert, 2024d), fossil crocodilians (Hebert, 2025a), fossil *Crassostrea* oysters (Hebert, Overman, and Sherwin, 2024), small fossil mammals (Hebert, 2024b, 2025b), and fossil coelacanths (Hebert, 2024c). Interestingly, Artruc (2016, p. 10) alludes to the fact that many conventional paleontologists believe that ammonites in general were slow-growing animals characterized by giantism (Stevens, 1988). Since giantism and delayed maturation are positively correlated with long lifespans in living creatures (see summary in Hebert, 2023), published ontogenetic data for other ammonites could provide either direct or indirect evidence that other ammonites were also experiencing delayed maturation and long lifespans. Intriguingly, some paleontologists think ammonites living in deep water grew even more slowly than those living in shallow water (Artruc, 2016, p. 10)! I strongly encourage creationist paleontologists to look into this possibility.

Jake Hebert
Institute for Creation Research

References

Abele, D., J. Strahl, T. Brey, and E. Philipp. 2008. Imperceptible senescence: Ageing in the ocean quahog *Arctica islandica*. *Free Radical Research* 42(5):474–480. https://core.ac.uk/reader/11762321?utm_source=linkout (accessed March 20, 2025).

Artruc, E.G. 2016. Growth rate and ecology of the giant heteromorph ammonite *Diplomoceras maximum* using stable isotopes of accretionary shell carbonate. Honors thesis. Syracuse University. Thesis may be freely accessed, as of 5/1/2025 at https://experts.esf.edu/esploro/outputs/undergraduate/Growth-Rate-and-Ecology-of-the/99870844104826, (accessed March 20, 2025).

Artruc, E.G., and L.C. Ivany. 2016. Growth rate and ecology of the giant heteromorph ammonite *Diplomoceras maximum* using stable isotopes of accretionary shell carbonate. 51st Annual Northeastern Section GSA meeting. March 21–23, 2016. https://gsa.confex.com/gsa/2016NE/webprogram/Paper272500.html, (accessed March 20, 2025).

Beasley, G. 1990. Pre-Flood giantism: A key to the interpretation of fossil hominids and hominoids. *Journal of Creation* 4(1):5–55. https://dl0.creation.com/articles/p028/c02820/j04_1_5–55.pdf (accessed March 21, 2025).

Buick, D.P., and L.C. Ivany. 2004. 100 years in the dark: Extreme longevity of Eocene bivalves from Antarctica. *Geology* 32(10):921–924.

Clarey, T. 2020. *Carved in Stone: Geological Evidence of the Worldwide Flood*. Institute for Creation Research, Dallas, TX, p. 153.

Crame, J.A., A.G. Beu, J.R. Ineson, J.E. Francis, R.J. Whittle, and V.C. Bowman. 2014. The early origin of the Antarctic marine fauna and its evolutionary implications. *PLOS ONE* 9(12):e114743. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114743 (accessed March 20, 2025).

Cuozzo, J. 1998. What happens to the craniofacial structures of humans who live past 100 years? Neanderthal similarities. *Proceedings of the International Conference on Creationism*: Vol. 4, Article 12. https://digitalcommons.cedarville.edu/icc_proceedings/vol4/iss1/12/ (accessed March 21, 2025).

Cuozzo, J. 1999. *Buried Alive: The Startling Truth About Neanderthal Man* (2nd printing). Master Books, Green Forest, AR.

Hebert, L.(J.), III. 2023. Allometric and metabolic scaling: Arguments for design… and clues to explaining pre-Flood longevity? *Proceedings of the International Conference on Creationism*: Vol. 9, Article 18. https://digitalcommons.cedarville.edu/icc_proceedings/vol9/iss1/18/ (accessed March 21, 2025).

Hebert, J. 2024a. Giantism and delayed maturation in fossil sharks: Evidence for extreme longevity? *Creation Re-*

search Society Quarterly 60(4):267–283. https://www.creationresearch.org/crsq-journal/crsq-2024-volume-60-number-4/giantism-and-delayed-maturation-in-fossil-sharks-evidence-for-extreme-longevity (accessed March 20, 2025).

Hebert, J. 2024b. Late Pleistocene body size reduction: Evidence of a post-Flood decline in longevity? *Journal of Creation* 38(1):60–66.

Hebert, J. 2024c. The coelacanth – A 'missing link' to extreme lifespans in giant fossil fish? *Journal of Creation* 38(3):4–6.

Hebert, J. 2024d. *Ptychodus* shark fossils—indirect evidence for antediluvian longevity? *Journal of Creation* 38(3):7–9.

Hebert, J. 2025a. Fossil crocodilians grew larger and longer, and lived longer than extant crocodilians. *Creation Research Society Quarterly* 61(3):172–188. https://www.creationresearch.org/crsq-journal/crsq-2025-volume-61-number-3 (accessed March 20, 2025).

Hebert, J. 2025b. Fossil teeth reveal Methuselah-like longevity and delayed maturation in tiny pre-Flood (Jurassic) mammals. *Journal of Creation* 39(1):98–106.

Hebert, J., R. Overman, and F.J. Sherwin. 2024. *Crassostrea* oyster fossils show evidence of extreme longevity. *Creation Research Society Quarterly* 60(3):171–190. https://www.creationresearch.org/crassostrea-oyster-fossils-show-evidence-of-extreme-longevity (accessed March 20, 2025).

Humphreys, R. God's global warming worked just fine. https://creation.com/global-warming-facts-and-myths (accessed March 24, 2025).

Ivany, L.C. 2020. Lifespan, growth rate, and ecology of a giant heteromorph ammonite from Antarctica. Invited presentation. 2020 Geological Society of America. Paper No. 135–9. https://gsa.confex.com/gsa/2020AM/webprogram/Paper357534.html (accessed March 19, 2025).

Moss, D.K., L.C. Ivany, R.B. Silver, J. Schue, and E.G. Artruc. 2017. High-latitude settings promote extreme longevity in fossil marine bivalves. *Paleobiology* 43(3):365–382.

Moss, D.K., L.C. Ivany, and D.S. Jones. 2021. Fossil bivalves and the sclerochronological reawakening. *Paleobiology* 47(4):551–573.

Nielsen, J., R.B. Hedeholm, J. Heinemeier, P.G. Bushnell, J.S. Christiansen, J. Olsen, C.B. Ramsey, R.W. Brill, M. Simon, K.F. Steffensen, and J.F. Steffensen. 2016. Eye lens radiocarbon reveals centuries of longevity in the Greenland shark (*Somniosus microcephalus*). *Science* 353(6300):702–704.

Oard, M. J. 2014. Warm early Eocene Antarctica. *Journal of Creation* 28(3):17–18. https://creation.com/antarctica-was-once-very-warm (accessed March 20, 2025).

O'Connor, M.R. 2017. The strange and gruesome story of the Greenland shark, the longest-living vertebrate on Earth. *The New Yorker*. https://www.newyorker.com/tech/annals-of-technology/the-strange-and-gruesome-story-of-the-greenland-shark-the-longest-living-vertebrate-on-earth (accessed May 15, 2023).

Patten, D. W. 1982. The longevity accounts in ancient history. *Creation Research Society Quarterly* 19(1):40–52. https://www.creationresearch.org/crsq-1982-volume-19-number-1_longevity-accounts-in-ancient-history (accessed March 21, 2025).

Stevens, GR. 1988. Giant ammonites: A review. In *Cephalopods—Present and Past*. J. Wiedmann and J. Kullman, eds. Schweizerbart'sche Verlagsbuchhandlung: Stuttgart, Germany, pp. 141–166.

Whitcomb, J.C., and H.M. Morris. 1991. *The Genesis Flood: The Biblical Record and Its Scientific Implications* (35th printing). Presbyterian & Reformed Publishing Company, Phillipsburg, New Jersey.

Yirka, B. Ancient squid-like creature with paperclip-shaped shell may have lived for hundreds of years. *Phys.org*. https://phys.org/news/2020–11-ancient-squid-like-creature-paperclip-shaped-shell.html (accessed March 18, 2025).

Author and Title INDEX for Volume 61, 2024–2025

David V. Bassett*

This title/author index covers articles, panorama notes, and other features. For items with two or more pages, the reference is to the first page only. After the page number, a letter indicates which type of entry is involved: article (A), panorama note (P), research note (N), letter to the editor (L), book or video review (R), conference abstract (CA), cover photo (CP), or other departments (such as editorials, editor's forum, laboratory director's comments, president's remarks, photo essays, etc.) (D).

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*David V. Bassett, M.S., Cedar Hill, TX

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Letters to the Editor

The policy of the editorial staff of CRSQ *is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the* CRSQ *editorial staff or the Creation Research Society.*

Some Thoughts on Time by Arthur Manning [*CRSQ* 60:216–217 (2024)]

Dear Editor:

Congratulations to Arthur Manning for his remarkably lucid explanations on the nature of time. First, the sci-fi concept of travel backwards or forwards in time is refuted; except that the present is continuously converted into the future - but only at the rate God allows in the natural order. This relation of time to the elements of natural order is expressed in such relations as Faraday's Law and the metric of space, which can be expressed in the size of electrons and protons in rest state and spectral lines characteristic of the elements.

Manning tackles the "I've seen this movie before" theory of existence, in which God, in eternity, sits over a multi-dimensional map of the universe, as though everything that happens is like an NC [numerical control] machine running on a paper tape that God punched in the beginning. In Manning's world, the future is not yet determined; therefore, God does not see it on His map before it happens. Yet, God, he says, *knows* the future in a deterministic(?) sort of way by having all knowledge of the exact position, energy, etc., of each particle or wave in the universe, and can therefore *know*, rather than calculate, how things will turn out. God's knowing in eternity is not like human seeing or thinking in time sequence. God is sovereign, because He can perform miracles, defined as actions which violate the physical laws God created to regulate the universe in normal course. Man's analog to God's knowing is faith, as in Hebrews 11 - faith given by God out of His treasure house of knowledge. It is spiritual, not reckoned by natural law, but not discordant with natural law.

Manning's God is not capricious. There is purpose behind Jesus' miracles in the NT, to mark out His authority to speak because of His superiority to everything in Heaven, earth, sky, and sea, echoing Genesis 1 and the 10 plagues in refuting the supposed power of all so-called gods of the pagans. All very orthodox and supporting his conclusion that since God is unknowable to us in His Fullness, we must trust and worship Him with all praise, honor, and glory. Amen. One must applaud the devotional tenor and lack of hubris shown by both Manning and Jonathan Corrado in his response to Manning. So, what is missing? We'll get to that after a few comments about Corrado's response to Manning.

Corrado's point is clarification, for the most part, and reads very well. One sees slight problems with precise definitions, and philosophically "loose" statements, based on common, but unstated, presuppositions. He states, "According to physics..." What physics, whose physics?... I have a book entitled, *Time*, each page of which quotes the opinion or commentary of some famous scientist or savant attempting to answer the question: "What is time?" No conclusive answer is found in the book, because they either don't know,

or they disagree. If they had published a book entitled, *Mass*, one could expect exactly the same result! A great conflation of ideas appears in writings about "time" or "mass." Consider that we have atomic time, solar time, sidereal time, clock time, light time; just as we have gravitational mass, inertial mass, atomic mass, mass-energy, Avogadro's number (i.e., a specific number of fundamental particles). Many of our thoughts and writings on physical science are full of equivocation between these descriptions. [The writer, too, confesses guilt in this regard.]

If we say, time is a property (accident) of matter (an essence), okay. Time is contingent on matter. But, if we say, "…time is defined by changes in the state of things [or a series of events]," are we saying that time is *contingent* on events? Or, are we saying that time is *measured by* the duration between events? Do we know that duration between events is always the same? Isn't this circular: Duration is measured in time; and time is measured in duration? We have to assume that God is rational, not a prankster, and that the laws of physics work the same at every point in Earth's orbit around the Sun. The letter and the reply are excellent for stimulating thought about the topic of time.

The topic was examined with respect to time's ontological status, and to a lesser extent, the epistemology of time from Scripture. What is missing is an axiological analysis based on ethical implications of what Manning says about God's foreknowledge. One can read various passages in the Scripture that seem contradictory until one is able to view them in a larger context. Manning's statements about the minutiae of God's foreknowledge seem highly deterministic, and would not seem to allow for a doctrine of free will. Extreme determinism is a horror show that removes all meaning, and all moral responsibility from humanity. Perhaps Manning simply wanted to graciously spare us another episode of the Calvinism vs. Arminianism debate. The writer, however, longs for his explanation of how his detailed position allows for human free will, and therefore, the moral responsibility God longs to find in us.

George P. Drake
California City, CA

Response to Jerry Bergman

Dear Editor:

I was disappointed to read Jerry Bergman's article, "Does the Mature Creation Concept Explain the Solar System's Creation?" in the Winter issue of the *Creation Research Society Quarterly* (Volume 61:213–220). The paper was poorly conceived and poorly written, and it contained glaring errors. For instance, on page 213, this sentence appears: "Consequently, for all these reasons, Adam would have had to be created *ex nihilo* from dust with a fully functioning body and oxygenated blood traversing through his body." *Ex nihilo* is Latin for *out of nothing*. Dust is something. Therefore, the phrase, "…created *ex nihilo* from dust…" is contradictory. This error was repeated a few sentences later when Bergman wrote, "Likewise, the fruit trees in the garden would display maturity upon their *ex nihilo* creation." Genesis 1:11–12 makes it very clear that the earth brought forth plants, so plants were not created *ex nihilo* either. Even the reference that Bergman cited to support his claim (Philo of Alexandria) states as much, for it reads, "…God produced the whole race of trees out of the earth…." Perhaps Bergman does not understand what *ex nihilo* means, confusing it with rapid or instantaneous creation. The initial creation of Genesis 1:1 required *ex nihilo* creation, but much of God's creative acts the rest of the Creation Week in forming and filling the earth (in contrast to the initial state of the Earth described in Genesis 1:2) used matter already created *ex nihilo* on Day One.

There were problems with numbers in the article. On page 216, Bergman credited Laplace with being the first to develop the Nebular Hypothesis, but then three paragraphs later, Bergman wrote that that was over 300 years ago (Laplace was born 276 years ago). On page 215, Bergman wrote that the Earth "…rotates on its axis at 24,898 mph measured at the surface." Expressing a rotation rate with a linear speed is improper, but even if one took the maximum tangential speed on the Earth's equator, then the speed is slightly more than one thousand miles per hour, not nearly 25,000 miles per hour (that is the escape velocity from the Earth!). Bergman even computed this in a footnote. What Bergman meant to say in the article was that the circumference of the Earth is 24,898 miles.

On page 217, Bergman wrote, "Of note, electromagnetic forces are weak over great distances while gravitational forces exert significant attraction over great distances…" Both gravity and electromagnetism follow the inverse square law of distance, so they

both can exert force significantly over great distances (but only if there is net charge involved in the case of electromagnetism). Perhaps Bergman had the strong nuclear force in mind, for it has a very short range.

At least two references cited in the paper were missing from the reference list (Simon, 2023; and Simon and Zwart, 2009).

The paper lacked focus. From the title, I gathered that the point of the paper was the defense of mature creation, but much of the paper amounted to criticism of naturalistic origin theories of the Moon and the rest of the Solar System. It escapes me what this has to do with mature creation. Mature creation is the explanation many creationists invoke to explain the light travel-time problem, something that Bergman spent little time discussing. Bergman may have confused mature creation for the rapid way in which Creation occurred (in six days according to Exodus 20:11) as opposed to gradual formation over millions of years. Members of the Creation Research Society must subscribe to six-day creation, but not all members subscribe to mature creation as the solution to the light travel-time problem. Bergman spent little time discussing other solutions to the light travel problem. Only in the last paragraph before his conclusion did Bergman mention time dilation solutions, one class of proposed solutions to the light travel-time problem. Bergman parenthetically mentioned the major authors who have written on time dilation solutions, but Bergman failed to provide any references for those. Furthermore, Bergman omitted mention of any other solutions, such as Jason Lisle's ASC or my own *dasha* (or *matured* creation) solution.

As further evidence for a lack of focus, consider this from page 215: "However, as with the recent creation of Adam, substantial evidence argues that the Solar System is young." This was followed by a discussion of a recent James Webb Space Telescope observation of 5,000 galaxies near the edge of the visible universe that appeared mature rather than young, as expected by most astronomers. What does this have to do with the Solar System? The title of the paper was about the mature creation concept, explaining that the Solar System's creation, not the recent creation of the universe.

In his discussion of naturalistic theory of the Solar System's origin, Bergman failed to get the details correctly. For instance, on page 216, we find: "The material that created the Solar System and Earth was once allegedly a slowly rotating cloud, or nebula, of extremely hot gas." But a few sentences later, this sentence appears: "Thus, the Nebular Hypothesis postulates that about 4.6 billion years ago, the Solar System was formed by the gravitational collapse of this giant molecular cloud spanning several light-years across." Giant molecular clouds are extremely cold, with temperatures typically on the order of 10 K. But the next sentence reads, "Evolutionists believe that the Sun was also originally a giant cloud of ionized plasma that contracted due to the pull of gravity." Plasmas are very hot, too hot for the molecules in giant molecular clouds to exist. The naturalistic origin theory for the Solar System begins with a cold cloud of gas, not hot gas as Bergman claims. Bergman went on to state that the theory of solar system formation had rings of material thrown out by the contracting gas cloud. The theory, for some time, is that a disk of material was left behind (not thrown out) as the core of the cloud shrank to eventually form the Sun. Furthermore, Bergman's description gives the impression that the theory of the Sun's formation resulted in just the Sun from a single cloud. The theory posits that many stars formed along with the Sun. This entire discussion of the secular theory of the origin of the Solar System was very muddled; it seemed to be a conflation of many different theories going back more than a century. However, to be fair, the first paragraph on page 217 was an accurate description of some of the modern theory of naturalistic solar system formation, but the next paragraph mentioned ionized plasma freezing into the giant planets, which does not correctly reflect current thinking.

Late in his paper (page 219), Bergman said that the mature creation concept "…does *not* include the idea that fossils were created *ex nihilo* in Earth rocks." I'm not sure what Bergman means by *ex nihilo* here. I suppose that Bergman's objection to God creating fossils in rocks is that those fossils would amount to false history. Yet in the next sentence Bergman wrote that "…a mature, fully functioning universe, including starlight formed in transit, remains a credible option for the young-Earth creationist worldview," apparently never realizing that light created in transit amounts to a false history, for that light contains evidence of processes that never happened (if mature creation is the correct solution to the light travel-time problem).

Early in his paper (page 214), Bergman argued that the appearance of age is consistent with recent creation. One of my major complaints with the mature creation concept is that if apparent age is inherent in recent creation, then why do many creationists waste their time discussing evidence of recent creation? That would place recent creationists in the curious position of simultaneously arguing for apparent great age and apparent youth in creation.

We can and must do better.

Danny R. Faulkner
Hebron, Kentucky

Jerry Bergman's Reply to Danny Faulkner (response in bold)

Dear Editor:
I was disappointed to read Jerry Bergman's recent article, "Does the Mature Creation Concept Explain the Solar System's Creation?" in the Winter issue of the *Creation Research Society Quarterly* (Volume 61:213–220). The paper was poorly conceived and poorly written. Perhaps more concerning was that obvious problems with the paper were not spotted and corrected by reviewers and editors before publication.

It was edited by four different PhD-level creationists. Danny agrees with many evolutionists and, as is true of these evolutionists, clearly does not think very much of many well-known creationists.

For instance, on page 213, this sentence appears: "Consequently, for all these reasons, Adam would have had to be created *ex nihilo* from dust with a fully functioning body and oxygenated blood traversing through his body." *Ex nihilo* is Latin for *out of nothing*. Dust is something. Therefore, the phrase, "…created *ex nihilo* from dust…" is contradictory. This error was repeated a few sentences later when Bergman wrote, "Likewise, the fruit trees in the garden would display maturity upon their *ex nihilo* creation." Genesis 1:11–12 makes it very clear that the earth brought forth plants, so plants were not created *ex nihilo* either. Even the reference that Bergman cited to support his claim (Philo of Alexandria) states as much, for it reads, "…God produced the whole race of trees out of the earth…." Perhaps Bergman does not understand what *ex nihilo* means. The initial creation of Genesis 1:1 required *ex nihilo* creation, but much of God's creative acts the rest of the Creation Week in forming and filling the Earth (in contrast to the initial state of Earth described in Genesis 1:2) used matter already created *ex nihilo* on Day One.

This raises a good point. Ultimately, the creation of Adam and the fruit trees was from nothing. Dust would not have all the elements required for a human, especially the rare ones, so possibly the creation of Adam was dust plus all of the other requirements, which were *ex nihilo*. *Another problem would be determining what specifically was dust? Soil? What kind of soil?* The paper was already too long, and a discussion of this would have required another paper. One conclusion is here:

Adam wasn't literally formed from dust. The word for "formed"* (yatsar) *isn't always used for material formation (2 Kings 19:25) (Isaiah 37:26) (Psalm 33:15) (Psalm 94:20), to name a few. Genesis 2:7 doesn't have the preposition "from," which isn't in the Hebrew text. Thus, the verse should be read "then the Lord God formed* (yatsar-*ed) man (who is) dust of the earth." Adam is called dust to represent his mortality, not that he was made from dust directly. Dr. John Walton's book "The Lost World of Adam and Eve" supports this. The etymology for* [of] *the word Adam (H119) refers to redness or ruddy. In other words, Adam had reddish brown skin because he was made from reddish brown soil. Even Josephus writes: "This man was called Adam, which in the Hebrew tongue signifies one that is red, because he was formed out of the red earth."* Antiquities, Book 1, Ch 1, Section 2. ***Was he literally formed from the dust of the earth, or is it metaphorical for his mortality?[1]

It is apparent that a long paper would need to be produced to answer this.

There were problems with numbers in the article. On page 216, Bergman credited Laplace with the first developing the Nebular Hypothesis, but then three paragraphs later, Bergman wrote that that was over 300 years ago.

I should have said that the Nebular Hypothesis, also known as the Kant-Laplace Hypothesis, was developed over 300 years ago. It was first proposed by Emanuel Swedenborg in 1734, then further developed by Immanuel Kant in 1755 and independently by Pierre-Simon Laplace in 1796.

On page 215, Bergman wrote that the Earth "…rotates on its axis at 24,898 mph measured at the surface."

I was wrong. My mistake, which was not caught by any of the four reviewers.

The circumference of the Earth is around 24,898 miles (40,070 kilometers), and, hence, dividing the distance by time, it can be observed that the Earth is spinning at 1,037 mph.

My correction is

The rotational speed at the equator is 1,037 mph (1,670 km/h). The rotation speed is determined by the Earth's circumference and the time it takes to complete one rotation (i.e., 24 hours).

Expressing a rotation rate with a linear speed is improper, but even if one took the maximum tangential speed on the Earth's equator, then the speed is slightly more than one thousand miles per hour, not nearly 25,000 miles per hour (that is the escape velocity from the Earth!). Bergman even computed this in a footnote. What Bergman meant to say in the article is that the circumference of the Earth is 24,898 miles. Given that this was cor-

1 https://www.reddit.com/r/AcademicBiblical/comments/t2b3ui/was_adam_literally_made_from_the_dust_of_the_earth/?rdt=59561.

rectly shown in a footnote, why did no reviewer or editor notice this blunder?

A major problem is that we have very few PhD-level qualified astronomers in the creation movement. Some do not agree with my conclusion and therefore refused to review my paper. One sent a very nasty note condemning me.

On page 217, Bergman wrote, "Of note, electromagnetic forces are weak over great distances while gravitational forces exert significant attraction over great distances…" Both gravity and electromagnetism follow the inverse square law of distance, so they both can exert force significantly over great distances (but only if there is net charge involved in the case of electromagnetism). **True, but gravity is strong enough to keep the dwarf planet Pluto in orbit, a body, on average, some 5.9 billion kilometers (3.67 billion miles) away from the Sun,** but perhaps Bergman had the strong nuclear force in mind, for it has a very short range. Any reviewer knowledgeable of physics likely would have caught this error.

I did not have the strong nuclear force in mind, and two reviewers had PhDs in physics.

At least two references cited in the paper were missing from the reference list (Simon, 2023; and Simon and Zwart, 2009). A good proofreader should have caught this.

The problem was that I used a secondary source. And, Danny infers, that well-known PhD creationists are not very good reviewers. This is a slam on all creationists.

The paper lacked focus. From the title, I gathered that the point of the paper was a defense of mature creation, but much of the paper amounted to criticism of naturalistic origin theories of the Moon and the rest of the Solar System. It escapes me what this has to do with mature creation. Mature creation is the explanation many creationists invoke to explain the light travel-time problem, something that Bergman spent little time discussing.

This was not my interest or my focus.

Bergman may have confused mature creation for the rapid way in which creation occurred (in six days according to Exodus 20:11) as opposed to gradual formation over millions of years. Members of the Creation Research Society must subscribe to six-day creation, but not all members subscribe to mature creation as the solution to the light travel-time problem. Bergman spent little time discussing other solutions to the light travel problem.

This was not my interest or focus.

Only in the last paragraph before his conclusion did Bergman mention time-dilation solutions, one class of proposed solutions to the light travel-time problem. Bergman parenthetically mentioned the major authors who have written on time-dilation solutions, but Bergman failed to provide any references for those. Furthermore, Bergman omitted mention of any other solutions, such as Jason Lisle's ASC or my *dasha* (or *matured* creation) solution.

As further evidence for a lack of focus, consider this from page 215: "However, as with the recent creation of Adam, substantial evidence argues that the Solar System is young." This was followed by a discussion of a recent James Webb Space Telescope observation of 5,000 galaxies near the edge of the visible universe that appeared mature rather than young, as expected by most astronomers. What does this have to do with the Solar System? The title of the paper was about the mature creation concept, explaining the Solar System's creation, not the recent creation of the universe.

Only a small part of my interest was related to the creation of the universe.

In his discussion of the naturalistic theory of the Solar System's origin, Bergman failed to get the details correct. For instance, on page 216, we find: "The material that created the Solar System and Earth was once allegedly a slowly rotating cloud, or nebula, of extremely hot gas." But a few sentences later, this sentence appears: "Thus, the Nebular Hypothesis postulates that about 4.6 billion years ago, the Solar System was formed by the gravitational collapse of this giant molecular cloud spanning several light-years across." Giant molecular clouds are extremely cold, with temperatures typically on the order of 10 K. But the next sentence reads, "Evolutionists believe that the Sun was also originally a giant cloud of ionized plasma that contracted due to the pull of gravity." Plasmas are very hot, too hot for the molecules in giant molecular clouds to exist. The naturalistic origin theory for the Solar System begins with a cold cloud of gas, not hot gas as Bergman claims. Bergman went on to state that the theory of solar system formation had rings of material thrown out by the contracting gas cloud. The theory, for some time, has been that a disk of material was left behind (not thrown out) as the core of the cloud shrank to eventually form the Sun. Furthermore, Bergman's description gives the impression that the theory of the Sun's formation resulted in just the Sun from a single cloud. The theory posits that many stars formed along with the Sun. This entire discussion of the secular theory of the origin of the Solar System was very muddled; it seemed to be a conflation of many different theories going back more than a century. However, to be fair, the first paragraph on page 217 was an accurate description of some of the modern theories of naturalistic solar system formation, but the next paragraph mentioned ionized plasma freezing into the giant planets, which

does not correctly reflect current thinking.

My paper was not about the details of the Nebular Hypothesis. My research on this topic revealed many conflicting claims, which is obvious from Danny's comments. I had to summarize some of the views, which, as Danny correctly noted, are conflicting.

Late in his paper (page 219), Bergman said that the mature creation concept "…does *not* include the idea that fossils were created *ex nihilo* in Earth rocks." I'm not sure what Bergman means by *ex nihilo* here. I suppose that Bergman's objection to God creating fossils in rocks is that those fossils would amount to false history.

No. My concern is if this was done in an attempt to fool the finder.

Yet, in the next sentence, Bergman wrote that "…a mature, fully functioning universe, including starlight formed in transit, remains a credible option for the young-Earth creationist worldview," apparently never realizing that light created in transit amounts to a false history, for that light contains evidence of processes that never happened (if mature creation is the correct solution to the light travel-time problem).

Early in his paper (page 214), Bergman argued that the appearance of age is consistent with recent creation. One of my major complaints with the mature creation concept is that if apparent age is inherent in recent creation, then why do many creationists waste their time discussing evidence of recent creation? That would place recent creationists in the curious position of simultaneously arguing for apparent great age and apparent youth in creation.

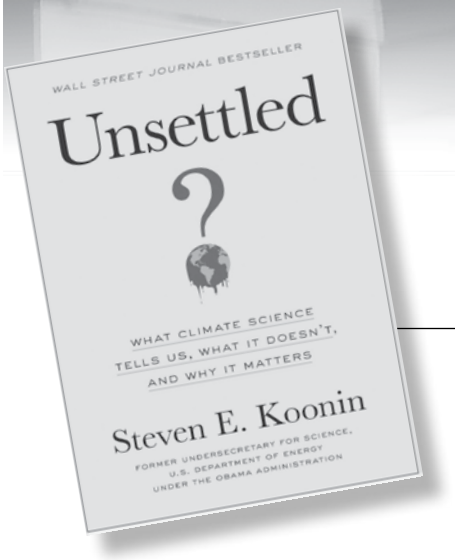
My paper was not mainly about the Nebular Hypothesis, I did mention it briefly, so I did not include the detail Danny mentioned.

My conclusion is, I was told my paper would engender a lot of hostility, and that it did. Danny must have spent many hours attempting to discredit my paper. Part of the reason is that creation models tend to be based on a few scriptures, a few facts, and lots of speculation. Mine is no exception. This is my first attempt to produce a creation model. And the response was a lot of name-calling and distortion of facts both before and after it was published. I am very used to his response because evolutionists commonly respond this way, or worse.

To do better, we need to work with each other, support each other, and not spend so much time attacking each other by making slanderous claims. When I became part of the creation movement in 1964, 73% of all Americans claimed to be creationists of some type. The latest Gallup Poll shows only 37% accepted that God created humans within the last 10,000 years. Belief in creation science and God-guided evolution reached their peaks of 47% and 40%, respectively, in 1999, and have since trended downward. Support for evolution without divine intervention has nearly tripled since 1999. (Source: Brenan, Megan. 2024. Majority still credits God for humankind, but not creationism. *Gallup*, https://news.gallup.com/poll/647594/majority-credits-god-humankind-not-creationism.aspx, July 22.) We are effectively disproving evolution, but at the same time are losing the war. It is estimated that by 2050, the YEC view will be under 15 percent. The fighting among ourselves does not help us.

Jerry Bergman

Media Reviews



Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters

by Dr. Steven E. Koonin

BenBella Books, Dallas, 2021, 320 pages, $13.79

Disclaimer: ***Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters*** **was written from an old earth, secular perspective.**

While taking a climatology course during my master's program, I began to question the dogmatic way in which climate change was discussed, almost as if no respectable scientist would ever question the "fact" that Earth was experiencing a climate crisis. That is when I came across *Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters* by Dr. Steven E. Koonin, the Former Undersecretary for Science, U. S. Department of Energy, under the Obama Administration. Dr. Koonin has published more than 200 peer-reviewed papers in physics, astrophysics, energy policy, and climate science. Additionally, he was the vice president and provost at Caltech, as well as a professor of theoretical physics, along with many other professional accolades. I felt confident his views carried weight, so I decided to read the book and see what a scientist from an adjacent field was saying about the climate change debate. To my relief, Dr. Koonin's book presented the subject from an unbiased viewpoint, free of political and financial entanglement. He skillfully addressed the complexity of the climate system, emphasizing both the strengths and weaknesses of the current state of climate science, while respecting all sides of the issue.

The book is divided into two parts: the first dealing with the science and the second dealing with proposed responses to climate change. Though the second part covers a few interesting pathways beyond the typical "chimera of carbon-free," for the purposes of this review, I will focus on the first section, which examines the current state of climate science.

The first three chapters address the complexity of the climate system, covering what the data shows regarding climate change, the challenges of attribution (ie. anthropogenic versus natural variability), and how these challenges are addressed by organizations, such as the Intergovernmental Panel on Climate Change (IPCC). It should be no surprise at this point that the Global Surface Temperature Anomalies show a steady increase for the past 40–50 years. Likewise, the Monthly CO_2 Concentration has shown a steady increase since the 1950s; this data is not disputed by creation scientists. What is disputed, and what Dr. Koonin so succinctly explains, is the supposed "climate catastrophe," or in his words, "apocalypses that ain't."

Capturing all the positive and negative feedback mechanisms in the climate system, then correlating those to anthropogenic or natural influence is one of the fundamental problems in climate science. According to Dr. Koonin, "Human influences currently amount to only 1 percent of the energy flows through the climate system…To usefully measure them and their effects, we have to observe and understand the larger parts of the climate system (the other 99 percent) with a precision better than 1 percent." Determining whether variability is attributable to anthropogenic or natural forcing is incredibly complex. Extrapolating this variability to future scenarios (another fundamental problem) proves even more challenging, especially considering projections are based on climate models (covered in Chapter 4), which are directly linked to our understanding of complex anthropogenic and natural forcings.

After examining the complexity of the climate system, the following five chapters discuss climate trends, such as those observed in tropical cyclone and small-scale severe weather, in which the IPCC reports low confidence. According to Dr. Koonin, low confidence is a function of "short and low-quality historical records, high natural variability, confounding natural influence, and disagreements among the models used." What this implies is that our understanding of the science is still developing. This is not to criticize the climate community,

but rather to refute claims implying the science is "settled."

The final two chapters focus on "fixing the broken science." They discuss the role that each stakeholder (ie. media, politicians, scientific institutions) played in breaking it, then a pathway forward for increasing transparency in climate change discussions. Even as these chapters identify specific groups, the tone is not overly accusatory, rather it highlights unconscious bias, which everyone should account for when analyzing and conducting scientific research.

Regarding the pertinence to creation research, climatology provides a nice overlap between historical and observational science. The current paradigm is wholly based on old-Earth dogma, which necessitates high climate sensitivity. A young-Earth-creation framework provides a fresh perspective in which the climate system does not demand high sensitivity. In fact, Genesis 8:22 leads me to believe research would show sensitivity is significantly lower than theorized. This is not to propose that creationists make projections about the future state of the climate, but rather that we highlight the robust climate system that God created. In doing so, we can increase our understanding of the "99 percent," while also glorifying our Creator.

Kadyn Kunisaki

A Review of Two Books Attempting to Disprove Intelligent Design:

The Unintelligent Designer: ***Refuting the Intelligent Design Hoax.*** **Rosa Rubicondior**. CreateSpace Independent Publishing Platform, 2018 (1st edition), 160 pages. Hard cover $19.00.

The Malevolent Designer: ***Why Nature's God is Not Good (Unintelligent Design).*** **Rosa Rubicondior.** Independently published, 2020, 222 pages. Hard cover $20.00.

A long-term interest of mine is grappling with the two major claims made by evolutionists against the human body, namely that it has "useless organs" and that it manifests "poor design." One reason for my interest is that I have taught anatomy and physiology, in addition to human biology and psychology, at a medical school and a liberal arts college. Many scientific books and articles claim that humans have numerous useless organs or that many of our functional organs are poorly designed. These claims have provided an abundance of ideas to write about. In the past few years, I, along with others, have published six books and scores of articles in response to the claims of poor design and useless organs.

These two claims, "useless organs" and "poor design," have been around since Darwin introduced the idea of what he called "rudimentary organs" in 1859. This idea is one of the main staples evolutionists rely on in attempting to disprove both creationism and Intelligent Design. This area of thought has become my niche. Others have also published writings dealing with this area including the late cell biologist David Menton, who taught anatomy at Washington University, as well as the president of the Institute for Creation Research, Dr. Randy Guliuzza, M.D.

The latest evolutionary books addressing this subject include two published by a man who writes under the pseudonym Rosa Rubicondior. Rosa is a biologist and a lifelong atheist who has written 13 books against Christianity and Intelligent Design. Most of his books focus on one theme: So much evil and poor design exists in the world that there could not be a God, or if there is, He is an evil genius. All of Rosa's books focus on Darwin and evolution in harmony with the belief that, as asserted by Richard Dawkins, Darwin's theory "made it possible to be an intellectually fulfilled atheist" (Dawkins, 1986, p. 6).

He notes that before Darwin, 99.9 percent of naturalists were creationists. Today, after Darwin, 98 percent of all eminent scientists are functional atheists, persons living their lives as if there is no God.

The Unintelligent Designer

This book was a gold mine of examples that should encourage Intelligent Design/creationism supporters to do their homework in response to its claims. The book also contains endless examples of name-calling and misinformation. An example of such misinformation is an attempt to counter Behe's documentation that the bacterial flagellum is an example of irreducible complexity (IC). Rosa claims that the bacterial flagellum is *not* irreducibly complex because, when Behe wrote his book, the evolution of the bacterial flagellum was documented. Thus we "know" that it has evolved and therefore it could not be an example of IC (2018, p. 53). An example of name-calling is claiming that Intelligent Design is "nothing more than Fundamentalist religion and one that cherry-picks from the holy books" (2018, p. 32).

Another concern was Rosa's claim, quoting the Kitzmiller Dover Court case, that Behe admitted that no peer-reviewed articles existed by anyone promoting Intelligent Design in the area of biology supported by pertinent experiments (2018, p. 53). The author should have detailed why this lack of peer-reviewed articles was largely, but not completely, true. The Creation Research Society was formed in 1964 primarily because it was very difficult for creationists to publish in secular journals.

Some of the books that carefully document this fact include *Heretic: One Scientist›s Journey from Darwin to Design; Science But Not Scientists; Slaughter of the Dissidents: The Shocking Truth About Killing the Careers of Darwin Doubters; Silencing the Darwin Skeptics; Censoring the Darwin Skeptics: How Belief in Evolution is Enforced by Eliminating Dissidents;* and *Free to Think.* I am aware of at least 48 other books which make this same point.

If Rosa were aware of the current hostile environment in science facing those who reject orthodox Darwinism, he might well have a different attitude.

The Malevolent Designer

This book attempts to prove that God does not exist by documenting the fact that, sooner or later, all animals die, some in horrible ways. In other words, God is not good because all life is mortal, all life ages, and eventually all life dies. A good God, he argues, would design life to be immortal, and to live a healthy life forever. This, in fact, is what God intended before Adam and Eve exercised their free-will to transgress His Edenic directive in Genesis, Chapter 3. However, it is obvious that ideal would not work in our fallen world because some method is required to prevent some forms of life, like bacteria and rabbits, from taking over the world. Ecology requires a balance of birth and death.

Also covered is the problem of disease, ignoring the fact that a major cause of disease is due to the mutation load that has been building up in humans for the past 6,000 years. Thus disease has become more common in each generation of humans. The mutation load in humans now causes over 7,000 genetic diseases. Christianity teaches the doctrine of the Fall of Man, with its consequent Curse, explaining the origin of sin, death, and disease.

A main concern related to both of the two books reviewed here is that authors should do their homework. For example, Rosa's claim that the plica semilunaris in humans is the vestige of the nictitating membrane (2020, pp. 136–137) was disproved over a century ago. The nictitating membrane is the transparent or translucent third eyelid present in some animals. It can be drawn across the eye for protection, and also to moisten the cornea while maintaining visibility.

The plica semilunaris is *not* the vestige of a nictitating membrane. It is a small fold of bulbar conjunctiva tissue on the medial canthus of the eye. It has several important functions. During eye movement, it helps to maintain tear drainage and also flushes debris from the eye via the lacrimal lake. Another function is that it permits greater rotation of the eyeball. Without the plica, the conjunctiva would attach directly to the eyeball, greatly restricting its movement.

Even worse are the blind spot and "backward" retina claims Rosa made (2020, pp. 137–138). Both claims were refuted decades ago. The rods and cones must have contact with the retinal pigment epithelium (RPE) in order to function. Therefore, the retina's rods and cones face away from the light, and the nerves, located in between the retina and the vitreous body, must pass through the retina, creating the "blind spot," required to transverse the optical nerves to the occipital lobe in the back of the brain where vision is processed (see Figure 3).

The RPE must closely interact with photoreceptors for several reasons, including the secretory activity of the

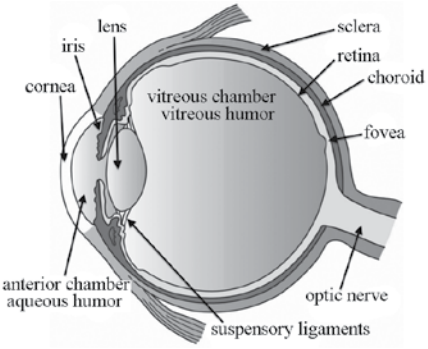


Figure 1. The structure of the eyeball. The optical nerve is where the blind spot is located. The fovea is the most sensitive part of the eye. From Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Three_Main_Layers_of_the_Eye.png.

RPE which plays an important role in establishing the immune system of the eye by secreting immunosuppressive factors. The RPE also takes up nutrients, such as glucose, retinol, and fatty acids from the blood and delivers these nutrients to the photoreceptors. It also removes waste products from the eye's rods and cones.

The RPE is so essential for proper vision that a failure of any one of its functions leads to retinal degeneration, loss of vision, and eventually blindness. One excellent journal description is "The Retinal Pigment Epithelium in Visual Function" by Olaf Strauss, which illustrates the concept of irreducible complexity: "Mutations in genes that are expressed in the RPE can lead to photoreceptor degeneration. Conversely, mutations in the genes expressed in photoreceptors can lead to degenerations of the RPE. Thus both tissues can be regarded as a functional unit where both interacting partners depend on each other" (Strauss, 2005, p. 845).

Conclusion

The "poor design" and "useless organs" arguments have been repeated hundreds of times in the anti-design and anti-creation literature in spite of the overwhelming evidence against them in the peer-reviewed literature and the many books that disprove these claims (Bergman, 2024, 2024a).

Jerry Bergman

References

Bergman. J. 2024, revised version. *Useless Organs: The Rise and Fall of a Central Claim of Evolution*. Tulsa, Oklahoma: Bartlett Publishing.

Bergman, J. 2024a. *Poor Design: An Invalid Argument Against Intelligent Design*. Tulsa, Oklahoma: Bartlett Publishing, 230 pages.

Dawkins, Richard. 1986. *The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe Without Design.* New York, NY: W.W. Norton & Company.

Strauss, Olaf. 2005. The retinal pigment epithelium in visual function. *Physiological Reviews* 85(3):845–881; doi: 10.1152/physrev.00021.2004.

The Misted World of Genesis One

by Michael Drake

Wycliffe Scholastic, Auckland, New Zealand, 2020

Section 1 A True Text, Section 2 A True Message

339 pages, $12.50 paperback

"In July 2013 two distinguished biblical scholars separately visited Auckland New Zealand and spoke on Genesis One" (p. 3). They were Professor John Walton of Wheaton College and Professor John "Jack" Collins from Covenant Theological Seminary. Michael Drake, the author of *The Misted World of Genesis One*, is founding principal of a grade 1–13 Christian school in Auckland, New Zealand. His publications include books and papers on Biblical theology, Christian education, and practical Christianity. He found his belief challenged that Genesis One describes six 24-hour days. He listened to their lectures, read their written works, and viewed and listened to their recordings, which are representative of respected contemporary evangelical Old Testament scholarship, characterized by an awareness of Ancient Near Eastern literature and culture, genre, and other language conventions.

Here is his conclusion, "The result was a clarity I have never before known as to the meaning, message and significance of Genesis One." Translation: Genesis means exactly what it says!

Having reviewed other contemporary evangelical Old Testament scholarship, Drake found a spectrum of views from conservative to liberal, but "the plenary inspiration of an infallible Bible that expresses timeless propositional truth in the plain words used is no longer one of them."

Yet those theologians want to be known as evangelical and use an evangelical vocabulary for ideas that are not part of historical evangelicalism, but are instead heavily influenced by current philosophical trends like post modernism, scientism, commitment to evolution, and "sentimental Christian existentialism that displaces doctrine in favor of relationships" (p. 4).

"The fraternal of scholars redefining evangelicalism find in the expanding knowledge of ancient cultures, languages and literature, tools for understanding God's Word as God's Word." Aside from believing in God's Word, they sound just like the old liberals. "Virtually nothing is untouched: The Bible's plenary inspiration, its verbal inspiration, its epistemological priority, its transcendence and its conveying of the truth" (p. 4). Apparently if you have expanding knowledge, you have to apply it.

Why is Genesis One being targeted as incomprehensible without obtaining special knowledge of cultural and linguistic studies? Why not the virgin birth or the resurrection of Jesus? There is something special about the claims of Genesis. If you say, "I believe God created the heavens and the earth in six days, several thousand years ago," you are instantly looked on as certifiably weird. Believing in miracles can be excused as part of the mind game of religion, but don't mess with things confirmed by science, like evolution and millions of years.

But can they be confirmed? After Whitcomb and Morris' *The Genesis Flood* was published, a flood of peer-reviewed creationist literature began. Design in life was supported quickly and easily communicated to open-minded people by comparison with human design. Support for the Biblical timetable was slower in coming, but to those of us who came out of some form of belief in long ages, it took answers to a number of questions before we felt confident of supporting the idea to a potentially skeptical audience.

To a non-scientist, who accepts "the executive summary of evolution," it all fits together so neatly that any one of a number of "problems for the creationist" is considered fatal to that position. That would be the fossil record, the presence of missing links, the evolution of whales or horses, and distant starlight. The answers to these, while not as straightforward as comparing life to design in a watch, are eminently answerable. A non-scientific person, however, will likely be uninterested in what they consider a long or complicated explanation. A scientific person, in an academic environment, may risk his livelihood by even showing interest.

Intellectuals, whether or not they identify as Christians, find that simple answers are not particularly valued. It is a point of pride to be able to tolerate ambiguity. But inextricably, tolerance can turn into a downright affinity. Thus "deep" arguments are admired. And in cases where the argument is not supported by data or argument, ambiguity is essential.

John Walton has produced a deep theology in which death before sin is covered by the idea that God was most concerned with assigning functions to whatever was somehow mysteriously happening in the background. "God does not give details of how things have been formed" (p.77). A plain reading of the text surely indicates that God made them!

Walton, however, insists that the truth is hidden from all except the enlightened elite, contrary to the principle of the Reformation that the Word of God, in the hands of the believer, illuminated by the Holy Spirit, can arrive at the truth that God wants us to have.

What he misses is that Genesis One is not an example of Ancient Near Eastern culture's creation myths, where gods fight for supremacy in a pre-existing cosmos and man is created from fragments of a slain god laced with spit (p. 95).

Genesis is the truth, the whole truth, and nothing but the truth! God existed before anything else and created it all. Man, male and female, in the image of God, were made of the created material. Their function was assigned with their creation, to be fruitful and multiply and to rule over the creatures. And it was very good!

It is ironic that present day scholars, under the influence of present-day culture and language conventions, have managed to lose their way through Genesis One and never get to Genesis Three, where the arch-typical temptation, which parallels their own, is first exposed: question God's Word, tell a lie, then question God's motivation. Spin the result.

Ross S. Olson MD
Richfield, MN

Instructions to Authors

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Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 59:230–235.

Margulis, L. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.

Hitchcock, A.S. 1971. *Manual of Grasses of the United States*. Dover Publications, New York, NY.

Walker, T.B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* is a peer-reviewed technical journal. It has been gradually enlarged and modified, and is currently recognized as one of the outstanding publications in the field. In 1996 the *CRSQ* was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates the Van Andel Creation Research Center in Glendale, Arizona.

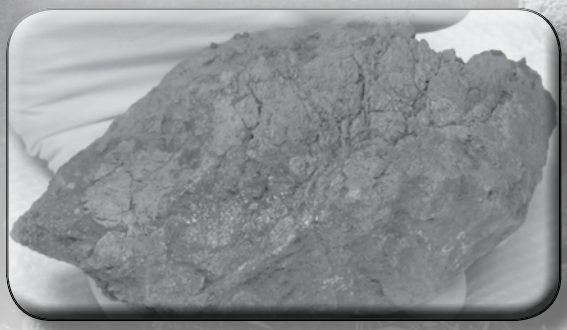
Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. *All members of the Society subscribe to the following statement of belief:*

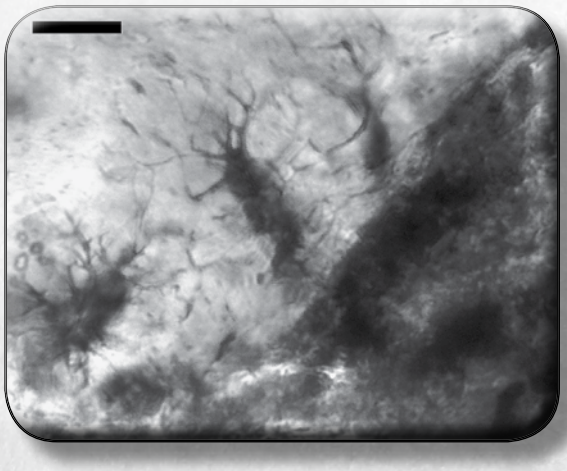
1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

iDINO II

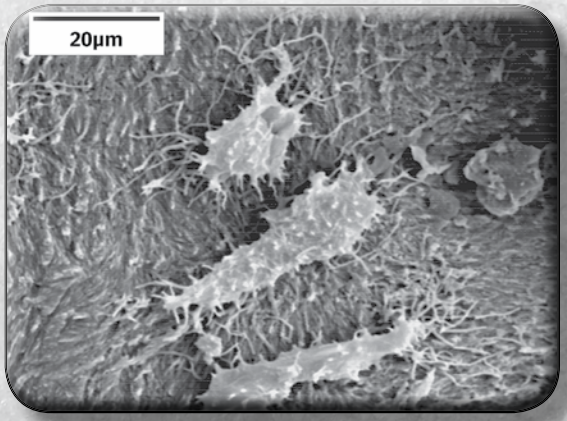
Investigation of Dinosaur Intact Natural Osteo-tissue



A fragment of the *Triceratops* brow horn. Fragments, such as this one, still contain tissue and cells.



Microscopic examination of tissue extracted from a *Triceratops* horn reveals bone cells still present.



Electron microscope picture of intact bone cells still in tissue extracted from a *Triceratops* horn.

How can pliable, stretchable tissue survive inside dinosaur fossils for over 65 million years?

How can this tissue still contain intact cells and even dinosaur proteins?

How can this fragile biological material survive for so long?

The answer to these questions directly challenges the current, evolutionary-biased, geologic timescale.

The Creation Research Society began its iDINO research initiative for the purpose of studying soft tissue in dinosaur fossils. The first phase of the project detected pliable, unfossilized tissue in a brow horn of a *Triceratops*. Within this tissue were intact osteocytes (bone cells). Some results from the iDINO project have been published in a technical microscopy journal and presented at an international microscopy conference. The Spring 2015 issue of the *Creation Research Society Quarterly* also features a special report of the iDINO project. Plus, to further spread the important information about soft tissue, the Society is developing a video (Echoes of the Jurassic).

The **second phase** of the project (iDINO II) will look more extensively at the process of tissue preservation. Evolutionists have offered various theories of how this tissue could survive for millions of years. iDINO II will methodically investigate these preservation claims, assessing their plausibility.

The iDINO results have already provided a strong challenge to the evolutionary worldview. More extensive and detailed examination may provide even stronger evidence that the age of dinosaur fossils is far less than 65 million years. To this end, the Society continues to seek those willing to fund this project with either one-time gifts or monthly donations.

For more information contact us at (928) 636-1153 or crsvarc@crsvarc.com.

Also visit http://tinyurl.com/nphm2c4 for project updates and details.

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